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Pesticides and Polychlorinated Biphenyls in the Atchafalaya Basin, Louisiana

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Pesticides and Polychlorinated Biphenyls in the Atchafalaya Basin, Louisiana

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September 1979

PESTICIDES AND POLYCHLORINATED BIPHENYLS IN THE ATCHAFALAYA BASIN, LOUISIANA

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The collection and analysis of samples for pesticide and polychlorinated biphenyls (PCB's) were included in the Atchafalaya River Basin Water and Land Study. From 1974 to 1977, 743 samples were collected from 118 stations in the Atchafalaya Basin. Water, bottom sediment, and fish samples were analyzed for 9 organophosphorus compounds and 18 organochlorine compounds. No organophosphorus compounds were detected in any fish, water, or bottom sediment samples. Only a few organochlorine compounds, i.e., aldrin, dieldrin, PCB's, chlordane, and DDT and its derivatives, are present in bottom sediments of the Atchafalaya Basin. With the exception of PCB's none of the compounds was detected in water samples. Aldrin, dieldrin, PCB's, and DDT and its derivatives were found in fish samples. The pattern of pesticide distribution that emerges in the Atchafalaya Basin reflects the agricultural activity within or affecting the various hydrological units of the Basin.

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a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Pesticides DDT Aldrin Dieldrin Chlordane Water pollution	Polychlorinated biphenyls Atchafalaya Basin	07C

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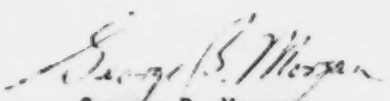
FOREWORD

Protection of the environment requires effective regulatory actions that are based on sound technical and scientific information. This information must include the quantitative description and linking of pollutant sources, transport mechanisms, interactions, and resulting effects on man and his environment. Because of the complexities involved, assessment of specific pollutants in the environment requires a total systems approach that transcends the media of air, water, and land. The Environmental Monitoring and Support Laboratory-Las Vegas contributes to the formation and enhancement of a sound integrated monitoring data base through multidisciplinary, multimedia programs designed to:

- develop and optimize systems and strategies for monitoring pollutants and their impact on the environment
- demonstrate new monitoring systems and technologies by applying them to fulfill special monitoring needs of the Agency's operating programs

This report presents the distribution and concentration of pesticides and polychlorinated biphenyls in the Atchafalaya Basin. These data can be utilized to formulate plans to minimize the environmental impact of proposed hydrological modifications. This report was written for use by Federal, State, and local government agencies concerned with water quality analysis, monitoring, and/or regulation. Private industry and individuals similarly involved with the Atchafalaya Basin will find the document useful. For further information contact the Water and Land Quality Branch, Monitoring Operations Division.



George B. Morgan
Director
Environmental Monitoring and Support Laboratory
Las Vegas, Nevada

CONTENTS

Foreword iii
Figures vi
Tables vii
Acknowledgments viii
Introduction 1
Conclusions 2
Recommendations 3
Description of Basin 4
Materials and Methods 14
  Station Coding 14
  Station Selection and Sample Collection 14
  Water and Bottom Sediment Analysis 15
  Fish Analysis 19
Results and Discussion 23
  General Findings 23
  DDT 25
  Polychlorinated Biphenyls 34
  Chlordane 39
  Aldrin-Dieldrin 41
  Distribution Patterns 42
References 46
Appendix A 48

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FIGURES

Number		Page
1	Base map of the Atchafalaya Basin	6
2-7	Station locations in the Atchafalaya Basin	7
8	Discharge hydrograph of the Atchafalaya River at Simmesport, Louisiana, 1963-1971	13
9	The location of stations where DDT, including its derivatives (DDE, TDE), was detected	30
10	The location of stations where PCB 1254 was detected	36
11	Location of stations where chlordane was detected	40
12	Location of the stations where dieldrin-aldrin was detected	43

TABLES

Number		Page
1	Number of water and bottom sediment samples collected at each sampling station	16
2	Organochlorine compounds with their minimum detection levels without Florisil cleanup	20
3	Organophosphorus compounds with their minimum detection levels without Florisil cleanup	21
4	Pesticide and PCB content of fish collected from Henderson Lake and the Courtableau area	24
5	Station, date, and sample type where DDT including its metabolites (DDE, TDE) was detected in water and bottom sediment samples	26
6	The distribution of DDT in bottom sediment samples by geographical area	29
7	Geographical area where DDT and its metabolites (DDE, TDE) were detected in fish samples	32
8	Station, date, and sample type where PCB 1254 was detected in water and bottom sediment samples	35
9	The distribution of PCB 1254 in water and bottom sediment samples by geographical area	37
10	Geographical area where PCB 1254 was detected in fish specimens	38
11	Station, date, and sample type where chlordane was detected in water and bottom sediment samples	41
12	Geographical area where dieldrin-aldrin was detected in fish specimens	44

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Without the cooperation of Dan Tabberer (U.S. Department of the Interior, Fish and Wildlife Service), who supervised the collection of the fish specimens and authorized the release of the unpublished data, the valuable information pertaining to fish would not be included in this report.

INTRODUCTION

The Atchafalaya Basin in south-central Louisiana is a large alluvial basin that has national significance as a multiple resource. It derives this significance principally from possessing high-quality habitats for fish and wildlife, being a semiwilderness area of high recreational value, and functioning as a floodway for the lower Mississippi River. To meet the need for flood control, the Army Corps of Engineers has proposed hydrological modifications (channel training or channelization) for the Basin. The Basin's present hydrological cycle and complex water circulation patterns support one of the world's most highly natural productive areas.

In response to a request by the Governor of Louisiana and a joint U.S. Congressional resolution, the U.S. Environmental Protection Agency, U.S. Army Corps of Engineers, and U.S. Department of the Interior are conducting a water and land quality study in the Atchafalaya River Basin. The study's objectives are to assess the potential impact of the proposed hydrological modifications and to develop alternative land and water management plans to accomodate floodflows and maintain an acceptable level of environmental quality for the Atchafalaya Basin.

The collection and analysis of samples for pesticides and polychlorinated biphenyls (PCB's) were included in the Atchafalaya River Basin Water and Land Study. From 1974 to 1977, 743 samples were collected from 118 stations in the Atchafalaya Basin. Water, bottom sediment, and fish samples were analyzed for 9 organophosphorus compounds and 18 organochlorine compounds. The purpose of this report is to present the distribution and importance of pesticides and polychlorinated biphenyls in the Atchafalaya Basin.

CONCLUSIONS

1. The Atchafalaya Basin is relatively free of organophosphorus pesticides. No organophosphorus compounds were detected in any fish, water, or sediment samples.

2. Only a few organochlorine compounds--aldrin, dieldrin, polychlorinated biphenyls (PCB's), chlordane, and DDT and its derivatives--are present in the bottom sediments of the Atchafalaya Basin. With the exception of PCB's, none of the compounds was detected in water samples. Aldrin, dieldrin, PCB's, and DDT and its derivatives were found in fish.

3. The pattern of pesticide distribution that emerges in the Atchafalaya Basin reflects the agricultural activity within or affecting the various hydrological units. The majority of the samples in which pesticides were identified were collected from the Courtableau, West Atchafalaya Floodway, Fausse Pointe Basin, Morganza Floodway, and the Fordoche areas, which contain agriculture or are directly impacted by agricultural drainage.

4. The highest concentration of PCB's was found in bottom sediments from waterways of an industrial area southeast of Morgan City, Louisiana.

RECOMMENDATIONS

Reductions in water level fluctuations of the Atchafalaya Basin result in increased agricultural activities within the Basin. The pattern of pesticide distribution that emerges in the Atchafalaya Basin reflects agricultural activity within the Basin or drainage from agricultural areas outside the Basin. Therefore, it is recommended that the natural regime of water level fluctuations that characterize the Atchafalaya Basin Floodway be maintained and that increased drainage of agricultural lands into the Basin be discouraged to avoid increased levels of pesticide contamination.

DESCRIPTION OF BASIN

The Atchafalaya Basin is a large, shallow depression located within the deltaic plain of the Mississippi River in southern Louisiana (Figures 1-7). It comprises a 4,662-kilometer^2 (km^2) lowland area confined between natural levee ridges that delineate the present and former courses of the Mississippi River. The overall dimensions of the study area are approximately 72 km by 193 km with elevation ranging from about 15 meters (m) to sea level. Maximum channel depths of approximately 49 m below mean sea level occur in scour pools, but the trunk channel of the Atchafalaya River is more typically 12 to 24 m below ground level with natural depths in lakes and bays being about 0.6 to 2.5 m.

Water enters the Basin from two major sources. Approximately 30 percent of the Mississippi River water flows through the Old River control structure, which eventually joins with the Red River to form the main stem of the Atchafalaya River. The Atchafalaya River discharge shows both seasonal and annual variation. The average monthly discharge hydrography for the Atchafalaya River at Simmesport for the period 1963-71 indicates the seasonality of flows (Figure 8). The flow generally begins to increase in December or January and crests in the period between April and early June. The flows normally drop off sharply to their seasonal lows in late summer and early fall. The cyclic nature of flow also describes the typical annual regime of flooding for the entire Basin.

In the upper one-third of the Basin, the channel-levee complex consists of a single, well-defined trunk channel bounded by levee ridges. Stage fluctuations are great, but overbank flooding is infrequent in this area. Basically, flooding of this area occurs at high-water periods when water "stacks up" and then flows north between the outside east and west protection levees and the inner levees associated with the main channel.

In the middle Basin, the trunk channel and levees lose their identity as they enter a very large depression where the flow and sediments of the system are no longer confined. This results in a decrease in velocity and an increase in cross-sectional area where velocity losses occur. The stream deposits sedimentary particles forming bars and shoals, forcing the river into a branching pattern. This portion of the Basin is an intricate mosaic of shallow-water lakes of various sizes and shapes, bayous, sloughs, channels, and distributaries. In the lower portion of the Basin, the river channel regains its identity. The total river flow, combined with rainfall from within the Basin, passes through two outlets, the lower Atchafalaya River outlet at Morgan City and the Wax Lake outlet.

Extensive swamps and freshwater-to-saline marshes characterize the Atchafalaya complex below Morgan City. The marshes and swamps have an intricate tidal-drainage network dependent on local runoff and tidal conditions.

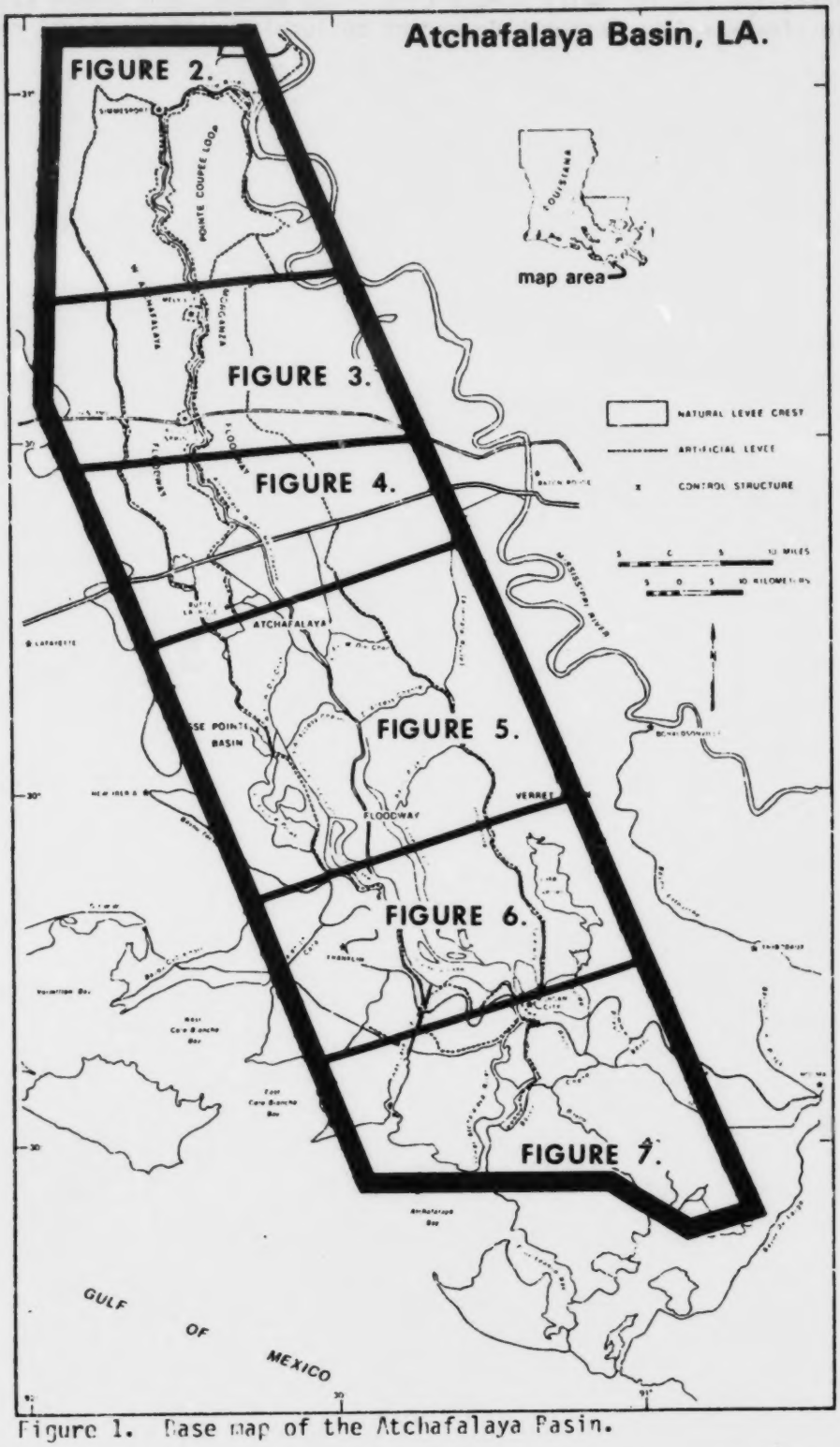

Figure 1. Base map of the Atchafalaya Basin.

Figures 2 - 7. Station locations in the Atchafalaya Basin.

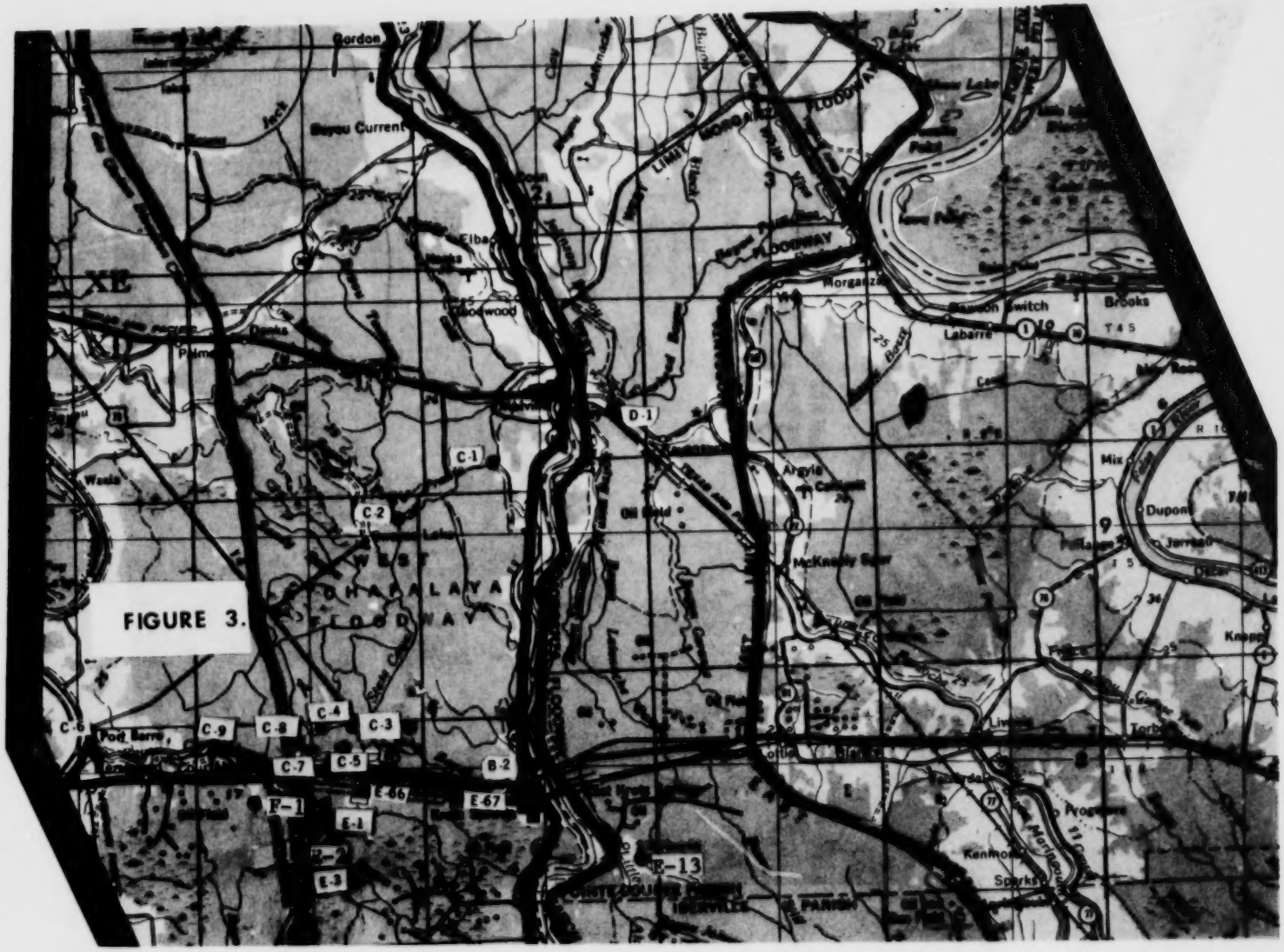
Gordon
Bayou Current
Elba
Woodwood
Morganza
Brooks
Labarre
Argyle
McKneely River
Dupont
Jarreau
Livonia
Kenmore
Sparks
C-1
C-2
C-3
C-4
C-5
C-6
C-7
C-8
C-9
D-1
E-1
E-2
E-3
E-13
E-66
E-67
F-1
B-2
WEST
ATCHAFALAYA
FLOODWAY
FLOODWAY
PARISH

FIGURE 3.

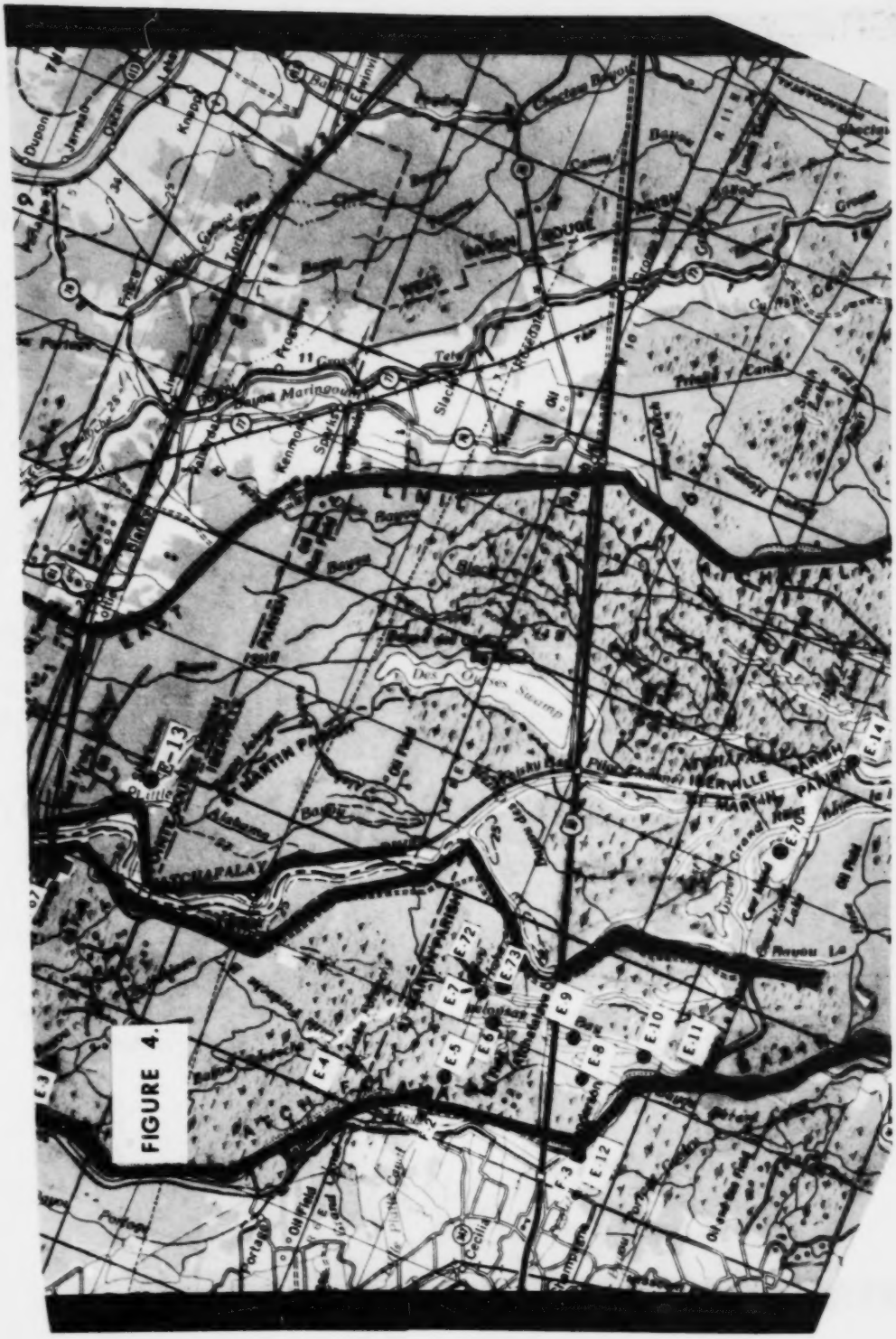
E-13
E1
E2
E3
E4
E5
E6
E7
E72
E73
E9
E10
E11
E12
E14
Maringouin
Des Ourses Swamp
Bayou La
CHAPALAY

FIGURE 4.

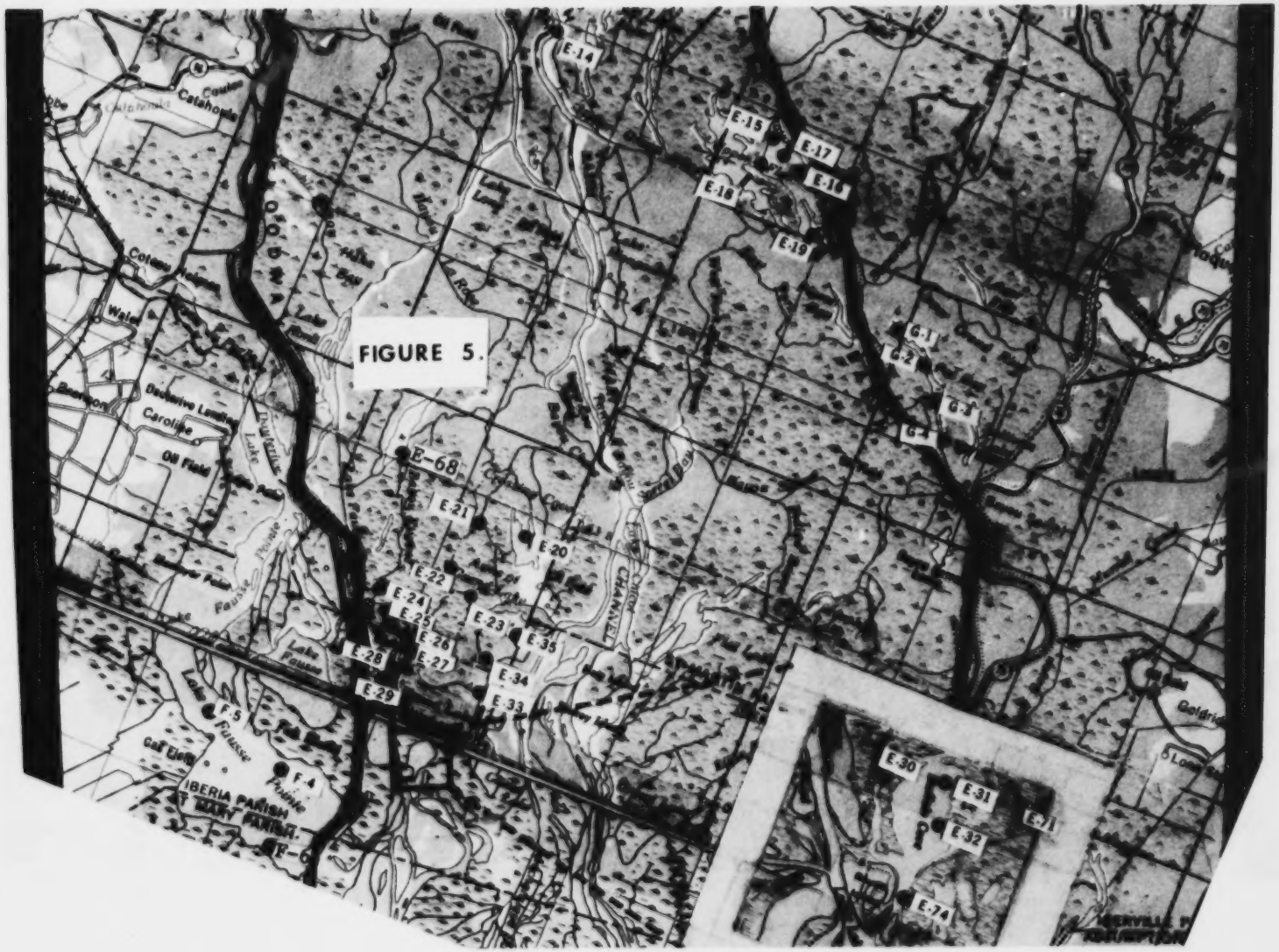
E-14
E-15
E-17
E-16
E-18
E-19
G-1
G-2
G-3
G-4
E-68
E-21
E-20
E-22
E-24
E-25
E-23
E-26
E-35
E-27
E-28
E-34
E-29
E-33
F-5
F-4
F-6
E-30
E-31
E-32
E-71
E-74
Catahoula
Cotton
Weld
Caroline
Oil Field
Lake Fausse
Fausse Pointe
CHANNEL
IBERIA PARISH
ST MARY PARISH

FIGURE 5.

LAKE
VERRET
BELLE
RIVER
LAKE
PALOURDE
Morgan City
OUTLET
BASIN
FLOODWAY
GRAND
LAKE
GRAND
LAKE
OUTLET
Franklin
Centerville
Baldwin
Jeanerette
Oil and Gas Field
Oil and Gas Field
Harris Bay
Oil and Gas Field
Charenton
Oil and Gas Field
Jeanerette
Oil and Gas Field
Adeline
Oil and Gas Field
Oil and Gas Field
Oil and Gas Field

OUTLET
H.13
H.12
H.11
H.10
H.9
H.7
H.4
H.2
G.12
G.13
G.14
Oil and Gas Field
Oil Field
Railway
Canal
Little Run

FIGURE 7.

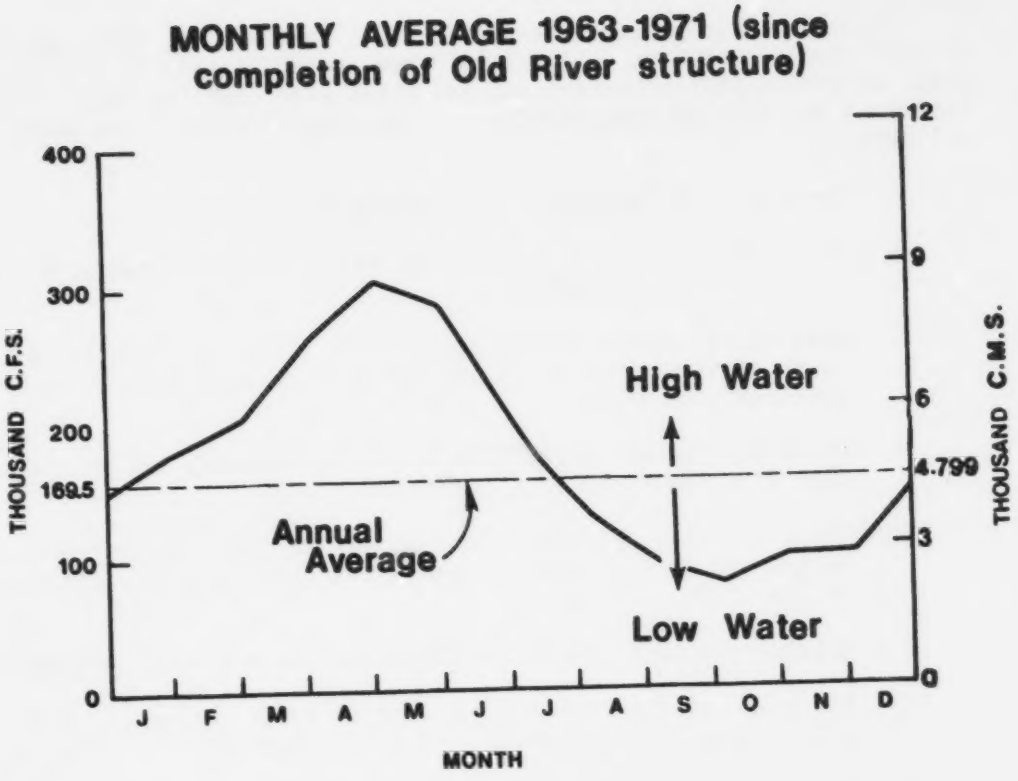

Figure 8. Discharge hydrograph of the Atchafalaya River at Simmesport, Louisiana, 1963-71 (Gagliano and van Beek, 1975).

MATERIALS AND METHODS

STATION CODING

A unique, four-place alphanumeric STORET code (e.g., E032) was assigned to each sampling station. STORET (STOrage and RETrieval) is the U.S. EPA computer system that processes and maintains water quality data. The first letter of the station code identifies a geographic area of the Basin as follows:

A - North of U.S. Highway 1 and Simmesport, Louisiana.

B - The main stem of the Atchafalaya River between Simmesport and Krotz Springs, Louisiana.

C - West Atchafalaya Floodway system, north of U.S. Highway 190, south of State Highway 1, and between the west protection levee and main stem levee.

D - Morganza Floodway system, north of U.S. Highway 190 and between main stem levee and east protection levee.

E - The Atchafalaya Floodway, bounded by the east and west protection levees and by U.S. Highway 190 on the north and U.S. Highway 90 on the south.

F - Outside the west protection levee and north of U.S. Highway 90.

G - All areas east of the east protection levee, north of U.S. Highway 90, and south of U.S. Highway 190.

H - All areas of the Basin south of U.S. Highway 90.

The next three digits designate the primary station number within a given geographic area. In Figures 2 through 7, abbreviated station numbers were utilized because of space requirements (e.g., A-1 instead of A001).

STATION SELECTION AND SAMPLE COLLECTION

Stations were selected to define water quality in the Atchafalaya Basin, including the distribution of pesticides, and to examine the productivity and energy export of habitats and the contribution of these to the Basin and estuarine areas (Figures 1-7). These stations provide representative data on dis-

tribution of pesticides and PCB's, because they are:

1. Geographically distributed throughout the Basin,
2. Located at the major inlet and outlets to the Basin,
3. Located at major water exchange points within the Basin,
4. Located in the Verret Basin adjacent to the east guide levee,
5. Located in the drainage basin to the west of the Atchafalaya River, and
6. Located in the freshwater swamps south of Morgan City.

Water samples for analysis were collected at the surface while bottom sediment samples were collected by using a grab-type bottom sampler. Samples were placed in 1-quart (0.95-liter) Mason jars equipped with Teflon lids. Before sample collection, the Mason jars and Teflon lids were washed with soap and water and rinsed first with distilled water and then twice with reagent-grade hexane.

Fish specimens were collected using an electrofishing device. Specimens were collected in the Fordoche area from Henderson Lake and in the Courtableau area.

A total of 721 samples (451 water and 270 bottom sediment) was collected from 116 stations for analysis (Table 1), while 7 fish specimens were analyzed from the Fordoche area and 15 from the Courtableau area.

WATER AND BOTTOM SEDIMENT SAMPLE ANALYSIS

Water Extraction

Five hundred milliliters (ml) of the water sample were extracted by shaking for 1 minute in a separatory funnel with three consecutive 100-ml portions of methylene chloride. The methylene chloride extracts were filtered into a 500-ml Erlenmeyer flask through a filter tube containing anhydrous sodium sulfate and a prewashed glass-wool plug. The sodium sulfate was then rinsed with 50 ml of methylene chloride. A Snyder column was added, and the apparatus was placed on an explosion-proof hotplate. The extract was taken to near dryness, 50 ml of hexane were added, and the extract was taken to near dryness again. This process was repeated three times, and the extract was concentrated to a final volume of approximately 5 ml. This extract was poured into a graduated centrifuge tube, and the volume was adjusted to 10 ml.

If cleanup was necessary, a portion of the 10 ml extract was cleaned up through Florisil® for electron-capture gas chromatographic detection of organo-

---

Florisil® - Trademark of [17]Floridin Company.

TABLE 1. NUMBER OF WATER AND BOTTOM SEDIMENT SAMPLES COLLECTED AT EACH SAMPLING STATION

Station	Water	Sediment	Total	Station	Water	Sediment	Total
A001	4	0	4	E017	3	2	5
A002	5	0	5	E018	1	1	2
A003	1	0	1	E019	5	5	10
A004	4	4	8	E020	5	3	8
B001	5	0	5	E021	2	2	4
C001	5	3	8	E022	0	1	1
C002	3	2	5	E023	2	1	3
C003	3	1	4	E024	2	2	4
C004	7	6	13	E025	3	3	6
C005	5	4	9	E026	2	2	4
C007	4	2	6	E027	5	4	9
C008	4	5	9	E028	4	1	5
D001	4	2	6	E029	1	0	1
E001	7	6	13	E030	2	2	4
E002	6	5	11	E031	3	3	6
E003	4	4	8	E032	6	4	10
E004	4	4	8	E033	3	3	6
E005	3	2	5	E034	3	3	6
E006	4	3	7	E035	4	2	6
E007	1	1	2	E036	3	2	5
E008	6	4	10	E037	1	0	1
E009	3	3	6	E038	2	0	2
E010	3	3	6	E039	2	0	2
E011	8	5	13	E040	3	1	4
E012	1	0	1	E041	4	2	6
E013	4	4	8	E042	3	1	4
E014	1	0	1	E043	6	3	9
E015	3	2	5	E044	4	2	6
E016	3	2	5	E045	3	1	4

(Continued)

(Continued)

TABLE 1. Continued

Station	Water	Sediment	Total
E046	3	2	5
E047	6	2	8
E048	4	0	4
E049	3	2	5
E050	5	3	8
E051	6	4	10
E052	4	1	5
E053	4	2	6
E054	4	1	5
E055	2	1	3
E056	4	2	6
E057	4	2	6
E058	4	3	7
E059	5	2	7
E060	1	0	1
E061	2	0	2
E062	3	0	3
E063	4	2	6
E064	1	0	1
E065	2	0	2
E072	5	6	11
F001	5	4	9
F002	2	1	3
F003	5	3	8
F004	5	1	6
F005	6	4	10
F006	6	3	9
F007	3	2	5
F008	4	3	7
F009	4	3	7
F010	0	1	1
F011	6	6	12
G001	5	3	8
G002	5	3	8
G003	6	4	10
G004	3	2	5
G005	5	3	8
G006	5	4	9
G007	4	3	7
G008	6	3	9
G009	7	4	11
G010	3	2	5
G011	3	2	5
G012	4	2	6
G013	2	1	3
G014	6	4	10
H001	2	0	2
H002	2	1	3
H003	6	3	9
H004	5	3	8
H005	7	4	11
H006	6	4	10
H007	6	4	10
H008	4	1	5
H009	5	3	8
H010	3	2	5
H011	4	2	6
H012	4	2	6
H013	4	2	6
H014	1	0	1

(Continued)

chlorine compounds. The remaining extract was reserved for injection on a flame photometric detector for organophosphorus compounds. Flame photometric detection normally did not require a cleanup.

Bottom Sediment Extraction

A 100-g subsample was taken from a thoroughly mixed sample. The subsample was extracted with 200 ml of 3:1 hexane:isopropanol solvent by shaking 4 hours on a reciprocating shaker. The isopropanol was removed by three distilled water washes, and the hexane extract was dried through anhydrous sodium sulfate. The sample extract was then stored at low temperature for subsequent gas-liquid chromatographic analysis.

If Florisil cleanup was necessary, a separate aliquot of the extract without Florisil cleanup was reserved for analysis on the flame photometric detector for detection of organophosphorus pesticides. The remaining extract was cleaned up on a Florisil column for electron capture detection of organochlorine compounds.

Removal of Sulfur Interference from Bottom Sediment Samples

Sulfur removal from bottom sediment samples was according to the method of Goerlitz and Law (1971).

Florisil Cleanup

An appropriate aliquot of the extract was fractionated through a 15-g Florisil column into two fractions by use of 100 ml of 10 percent methylene chloride in hexane and 100 ml of methylene chloride for fractions one and two, respectively.

Methylene chloride was removed by concentration of each extract to low volume under a three-ball Snyder column, addition of 100 ml hexane, and concentration again to low volume. After two additions of hexane, the methylene chloride was essentially removed. Each extract volume was adjusted to 2.5 ml for separate injection on the gas-liquid chromatograph.

Gas-Liquid Chromatography

Analyses were performed on gas chromatographs equipped with tritium foil electron affinity detectors for organochlorine compounds and thermionic or flame photometric detectors for organophosphorus compounds. A multiple-column system employing polar and nonpolar columns was utilized to identify and confirm pesticides. The following equipment and specifications were used to analyze the samples:

Gas Chromatographs: Hewlett-Packard 402A

	Hewlett-Packard 402B	
	"Tracor" MT-220	
Columns:	Glass, 6 mm outside diameter by 4 mm inside diameter, 183 cm long, packed with one of the following: 5 percent OV-210 on 80/100 mesh chromasorb W, HP; 3 percent DC-200 on 100/200 mesh Gas-Chrom Q; or 1.5 percent OV-17/1.95 percent QF-1 on 100/200 mesh sepelcoport	
Carrier Gases:	5 percent methane-argon at a flow rate of approximately 80 ml/min; prepurified nitrogen at a flow rate of approximately 80 ml/min	
Temperatures:	Thermionic detector housing	250°C
	Detector electron capture and flame photometric	200°C
	Injection port	250°C
	Column OV-210	166°C
	Column DC-200	170-175°C
	Mixed column	185-190°C

Recoveries

Recovery values on water and bottom sediment ran from 80 to 100 percent depending on the compound and substrate involved.

Specific compounds for which analysis was made are listed in Tables 2 and 3 with their minimum detection levels. The minimum detection levels were decreased approximately tenfold when Florisil cleanup was utilized.

FISH ANALYSIS

Extraction and Partition Procedures

The whole fish specimen was blended into a creamy homogeneous mixture and 50 g were transferred into a 500-ml Erlenmeyer flask. After the addition of 200 ml of acetonitrile, the sample was agitated on an automatic shaker at medium speed for 4 hours. The sample was transferred into a 250-ml separatory funnel by filtering it through glass wool with 50 ml of hexane added to the sample. The sample was agitated for 3 minutes, and after the sample settled, the lower layer (acetonitrile) was drained into a 500-ml separatory funnel. One hundred ml of acetonitrile-saturated hexane was added, agitated, the sample settled, and then the lower layer drained. This process was repeated three times, draining all the lower layers into the same separatory

TABLE 2. ORGANOCHLORINE COMPOUNDS WITH THEIR MINIMUM DETECTION LEVELS WITHOUT FLORISIL CLEANUP

Compound	Minimum Detection Levels[1]	
	Water (µg/liter)	Sediment (µg/kg)
Aldrin	0.1	10
Benzenehexachloride (hexachlorocyclohexane, BHC)	0.1	10
Benzenehexachloride - technical grade (hexachlorocyclohexane, BHC)	0.5	50
Captan	0.2	20
Chlordane technical	0.5	50
Dacthal	0.2	25
Dieldrin	0.1	10
Endosulfan	0.2	20
Endrin	0.1	10
Gamma - chlordane	0.1	10
Heptachlor	0.1	10
Heptachlor epoxide	0.1	10
Hexachlorobenzene (HCB)	0.1	10
O, P[1] - DDE	0.2	20
O, P[1] - DDT	0.4	40
PCB's (reported as PCB 1254)	0.5	50
P, P[1] - DDE	0.2	10
P, P[1] - DDT	0.4	10
P, P[1] - TDE	0.3	10
Toxaphene	0.5	50
Treflan	0.1	10

[1]Minimum detection levels were decreased approximately tenfold when Florisil cleanup was utilized.

TABLE 3. ORGANOPHOSPHORUS COMPOUNDS WITH THEIR MINIMUM DETECTION LEVELS WITHOUT FLORISIL CLEANUP

Compound	Minimum Detection Levels[1] Water (µg/liter)	Sediment (µg/kg)
Abate	0.1	10
DEF	0.1	10
Diazinon	0.1	10
Ethion	0.5	50
Ethyl parathion	0.5	50
Malathion	0.25	25
Methyl parathion	0.1	10
Phorate	0.1	10
Trithion	0.5	50

[1]Minimum detection levels were decreased approximately tenfold when Florisil cleanup was utilized.

funnel (300 ml total). Acetonitrile-saturated hexane (25 ml) was added and the sample was agitated. Then the acetonitrile layer (lower) was drained into a 500-ml Erlenmeyer flask. The acetonitrile was concentrated to about 10 ml on an explosion-proof hotplate. One hundred ml of hexane were added to the sample, and it was concentrated to 10 ml on an explosion-proof hotplate. The hexane addition and concentration processes were repeated. A Snyder column was rinsed with a small amount of hexane, with the hexane rinse draining into the flask containing the sample. The contents of the flask were transferred into a 15-ml centrifuge tube with a Teflon-lined screwcap and diluted to 15 ml with hexane.

Florisil Cleanup

A Shell column (joint 24/40, 26 cm long) was prepared with 20 g of Florisil, topped with 1.25 cm of sodium sulfate and vibrated to settle the packing material. Prior to utilization of a given lot of Florisil, the lot was verified with a mixture of pesticide standards to assure that separation was completed and the recoveries were quantitive.

The Florisil column was washed with a 100 ml of hexane. A 250-ml Erlenmeyer flask equipped with a 24/40 joint was placed under the column, and the contents of the 15-ml centrifuge tube were transferred to the Florisil column. The centrifuge tube was rinsed and its contents added to the column once the sample had passed the sodium sulfate layer. After all the extract had passed through the sodium sulfate layer, it was eluted with 150 ml of equal proportions of hexane and methylenedichloride. After the elution of the column had been completed, boiling beads were added to the collection flask and Snyder column. The sample was evaporated to 50 ml and then an additional 50 ml of hexane were added to the sample. The sample was evaporated to 5 or 10 ml and transferred to a test tube.

Gas-Liquid Chromatography

The fish samples were analyzed for chlorinated compounds on a Hewlett-Packard 5710A/7671A system utilizing the following specifications:

Oven temperature - 175°C

Detector temperature - 300°C

Injection port - 250°C

Column used - 3 percent OV-210

Attenuation - 16×10^2

Gas flow - 25 cm^3/min of methane and argon

Detection limits - 10 parts per billion (ppb) (wet weight)

The samples were analyzed for organophosphorus compounds utilizing a flame photometer incorporated with a Tracor MT-220 using the following specifications:

Oven temperature - 180°C

Detector temperature - 190°C

Injection port - 275°C

Column used - 3 percent DC 200

Attenuation - 8×10^2

Gas flow - 25, 80, and 55 cm^3/min of oxygen, hydrogen, and nitrogen, respectively

Detection limits - 10 ppb (wet weight)

Recoveries

The specific compounds for which analysis was made in the fish specimens were identical to the compounds for which analysis was made in the water and bottom sediment samples (Tables 2 and 3). However, the minimum detection limit ranged from 10 µg/kg to 50 µg/kg (wet weight) for all compounds.

RESULTS AND DISCUSSION

GENERAL FINDINGS

Appendix A summarizes the results of all water and bottom samples that were collected in the Atchafalaya Basin and analyzed for pesticide and PCB content. The appendix is organized by site-date combinations and is subdivided into the major categories of water and bottom sediment samples. Under the major subheadings, the classes of compounds--organochlorine and organophosphorus--are listed. Preceding the classes of compounds is the treatment method employed for the water or bottom sediment sample. Treatment method A refers to analysis without initial Florisil cleanup, while treatment method B refers to analysis subsequent to Florisil cleanup. When a specific compound was detected, it was listed under the appropriate class of compounds, and its concentration was recorded.

Organophosphorus pesticides are relatively short-lived in the environment, and none (abate, DEF, diazinon, ethion, ethyl parathion, malathion, methyl parathion, phorate, trithion) was detected in any of the water or bottom sediment samples. It should be noted that intermittent sampling for short-lived pesticides would have a very low likelihood of detecting periodic pesticide inputs.

Organochlorine compounds--benzenehexachloride (BHC), captan, dacthal, endosulfan, endrin, heptachlor, heptachlor epoxide, hexachlorobenzene (HCB), toxaphene, and treflan--were not detected in any of the water or bottom sediment samples, even though they are relatively long-lived in the environment. DDT, including its metabolites (DDE, TDE), was found in 78 bottom sediment samples and was the most common compound detected. PCB's were found in 16 water samples and 6 bottom sediment samples. It was the next most common compound detected. Other compounds detected include chlordane (found in seven bottom sediment samples) and dieldrin (found in one bottom sediment sample).

Fifteen fish specimens were collected from the Courtableau area north of U.S. Highway 190, and seven specimens were collected from Henderson Lake in the Fordoche area. Species collected were bluegill (*Lepomis macrochirus*), blue catfish (*Ictalurus furcatus*), bowfin (*Amia calva*), largemouth bass (*Micropterus salmoides*), river carpsucker (*Carpiodes carpio*), redear sunfish (*Lepomis microlophus*), spotted gar (*Lepisosteus productus*), and white crappie (*Pomoxis annularis*). Table 4 lists the pesticide or PCB content in µg/kg of wet weight by species and collection area.

TABLE 4. PESTICIDE AND PCB CONTENT OF FISH COLLECTED FROM HENDERSON LAKE AND THE COURTABLEAU AREA

Location and Species	Compound (µg/kg wet weight)									
	Aldrin	Chlordane	Dieldrin	Heptachlor	PCB 1254	p, p' DDE	p, p' DDT	p, p' TDE	o, p' DDE	o, p DDT
Henderson Lake:										
Bluegill	-	-	-	-	-	19	-	-	-	-
Bowfin	-	-	2*	-	-	-	3*	-	-	-
Largemouth bass	10	-	11	-	-	77	10	21	9*	-
Largemouth bass	-	-	-	-	-	-	-	-	25	-
Redear sunfish	-	-	2*	-	55	13	-	-	-	-
Spotted gar	-	5*	-	1*	-	49	25	9*	-	-
Spotted gar	-	-	4*	-	-	-	-	4*	30	10
Courtableau Area:										
Blue catfish	-	-	8*	-	-	343	-	95	16	30
Bluegill	-	-	-	-	-	-	-	-	250	-
Largemouth bass	-	-	3*	-	-	216	27	41	-	-
Largemouth bass	-	-	-	-	-	-	-	-	210	-
River carpsucker	-	-	-	-	-	124	4*	-	-	-
River carpsucker	-	-	6*	-	43	214	27	48	-	-
River carpsucker	-	-	4*	-	110	282	25	24	-	-
River carpsucker	-	-	10	-	171	1148	177	192	-	30
River carpsucker	-	-	8*	-	393	162	-	-	-	-
Spotted gar	-	-	-	-	-	382	38	66	-	-
Spotted gar	-	-	8*	-	-	364	30	236	-	-
White crappie	-	-	4*	-	-	159	-	4*	-	-
White crappie	-	-	12	-	-	222	-	-	-	-
White crappie	-	-	7*	-	-	94	-	5*	-	-
White crappie**	-	-	-	-	-	250	-	-	-	-

* Unconfirmed result (below detection limit).

** Homogenous mixture of four white crappie specimens.

Compounds that were detected in fish specimens were PCB's, aldrin, dieldrin, chlordane, and DDT and its metabolites. These compounds were also detected in water or bottom sediment samples.

The organochlorine compounds benzenehexachloride (BHC), captan, dacthal, endosulfan, endrin, heptachlor epoxide, hexachlorobenzene (HCB), toxaphene, heptachlor, and treflan were not found in fish.

Also, no organophosphorus compounds--abate, DEF, diazinon, ethion, ethyl parathion, malathion, methyl parathion, phorate, and trithion--were found in the fish.

The absence of endrin from fish, water, and bottom sediment samples is notable since it was the agent responsible for the catastrophic fish kills in the lower Mississippi River Basin in 1963-64 (U.S. Department of the Interior, 1969). In the 1963-64 comprehensive study, the endrin concentration ranged from 0.0 to 70.0 µg/kg in fish blood and from 0.02 to 0.36 µg/liter in water.

Other compounds that were detected in the fish specimens included PCB's, aldrin, dieldrin, chlordane, and DDT and its metabolites (p, p' DDE, p, p' TDE, o, p' DDE). These pesticides and the PCB's were the only compounds detected in the water or the sediment samples. Their distribution and importance will be discussed in subsequent sections.

DDT

In this discussion DDT [1, 1, 1-trichloro-2, 2-bis(p-chlorophenyl) ethane] refers to the sum total of DDT and its metabolites TDE and DDE. Because DDT is a highly persistent chemical, bioconcentrates in aquatic organisms used for human consumption, and is considered a potential human carcinogen, levels of DDT in water should be kept as low as feasible. The water quality criterion is 0.001 ppb for the protection and propagation of fish and other aquatic life (EPA, 1976).

Aquatic organisms generally exhibit acute toxicity to DDT at levels in the 1-ppb range. Some 96-hour LC_{50}'s (the dose of a toxicant that is fatal to 50 percent of the organisms under test conditions) that have been reported are: crayfish, *Orconectes nais*, 0.24 ppb (Sanders, 1972), and largemouth bass, *Micropterus salmoides*, 2.0 ppb (Macek and McAllister, 1970).

DDT will definitely bioconcentrate. Reinert's (1970) study of fish in Lake Michigan demonstrated concentration factors of up to 2 million times above background levels. Other fish bioconcentration factors demonstrated under laboratory conditions are in the thousandfold category instead of the millionfold range (Hansen and Wilson, 1970).

In this study DDT was detected in 78 of 270 possible bottom sediment samples and was found at 38 of 98 locations. DDT was never detected in 451 water samples collected from 118 stations (Table 5). Figure 9 details the

TABLE 5. STATION, DATE, AND SAMPLE TYPE WHERE DDT, INCLUDING ITS METABOLITES (DDE, TDE), WAS DETECTED IN WATER AND BOTTOM SEDIMENT SAMPLES

Station	Date	Sample Type	
		Water (µg/liter)	Bottom Sediment (µg/kg)
A004	12-18-75	--	21
C001	6-10-75	ND	50
	11-18-75	ND	90
	12-17-75	--	115
C002	11-18-75	ND	70
	12-17-75	--	32
C003	11-18-75	ND	50
C004	12-09-74	ND	50
	4-17-75	--	20
	6-11-75	ND	20
	9-10-76	ND	10
	9-30-76	ND	70
C005	6-11-75	ND	10
C007	11-29-75	ND	20
	4-19-77	ND	20
C008	9-01-76	--	50
	9-30-76	ND	150
	11-29-76	ND	140
	4-19-77	ND	40
	5-24-77	ND	100
D001	4-14-75	ND	20
	6-11-75	ND	10
E001	5-28-74	ND	130
	11-15-74	ND	20
	12-09-74	ND	240
	4-14-75	ND	100
	12-15-75	--	217
E002	5-28-74	ND	140
	11-15-74	ND	210

(continued)

ND = DDT and its metabolites not detected in sample.

TABLE 5. (Continued)

Station	Date	Sample Type: Water (µg/liter)	Sample Type: Bottom Sediment (µg/kg)
E002	6-11-75	ND	100
	12-15-75	--	73
	3-08-77	--	30
E003	11-19-74	ND	100
	12-09-74	ND	110
	6-11-75	--	30
	12-15-75	ND	54
E004	11-19-74	ND	140
	6-11-75	ND	140
	12-15-75	--	79
E005	11-19-74	ND	120
	6-12-75	ND	30
E006	11-19-74	ND	70
	6-12-75	ND	20
E009	11-19-74	ND	70
E011	6-12-75	ND	6
E013	11-19-74	ND	40
E020	11-15-74	ND	20
E022	12-12-75	--	16
E025	11-20-74	ND	60
E030	6-13-75	ND	12
E031	11-20-74	ND	40
E033	12-12-75	--	7
E044	12-16-75	ND	4
E049	4-18-75	ND	10
E050	4-18-75	ND	10
E051	4-15-75	ND	10
F001	11-19-74	ND	180
	12-09-74	ND	30
	12-15-75	ND	232

(continued)

TABLE 5. (Continued)

Station	Date	Sample Type: Water (µg/liter)	Sample Type: Bottom Sediment (µg/kg)
F003	11-19-74	ND	80
	12-12-75	ND	179
F005	6-13-75	ND	20
	11-15-75	ND	40
	12-12-75	ND	20
F008	6-14-75	ND	20
F009	12-12-75	ND	6
F010	12-17-75	--	76
F011	9-01-76	ND	40
	9-30-76	ND	90
	11-29-76	ND	140
	3-08-77	ND	20
	4-19-77	ND	40
	5-24-77	ND	40
G005	6-14-75	ND	20
G011	4-18-75	ND	10
G013	4-18-75	ND	10
G014	4-18-75	ND	10
H007	4-15-75	ND	10

locations where DDT was detected in fish and bottom sediment samples collected in the Atchafalaya Basin (to accurately depict the geographical distribution of DDT in the Basin only one symbol per station was used in the figure even if multiple occurrences of DDT were detected at a given station). The figure also illustrates eight different geographical areas, which are shaded and labeled with letter symbols: West Atchafalaya Floodway north of U.S. Highway 190 (WAF); Morganza Floodway north of U.S. Highway 190 (MF); Courtableau (CT); Fordoche (FD); Atchafalaya Basin Floodway south of U.S. Highway 190 and exclusive of Fordoche (ABF); Fausse Pointe Basin (FPB); Verret Basin (VB); and the area south of Morgan City (SMC).

Table 6 lists the range and mean concentration of DDT in bottom sediments for each geographical area shown in Figure 9. The mean and range calculations

TABLE 6. THE DISTRIBUTION OF DDT IN BOTTOM SEDIMENT SAMPLES BY GEOGRAPHICAL AREA

Geographical Area Symbol	Description	Concentration µg/kg Range	Mean	Number of Sampling Stations Where Detected/ Total Number of Sampling Stations	Percent of Sampling Stations Where Detected
WAF	West Atchafalaya Floodway	2.5 - 96.0	47.5	7/7	100
MF	Morganza Floodway	15.0 - 15.0	15.0	1/1	100
CT	Courtableau	16.6 -110.5	67.7	3/3	100
FD	Fordoche	0.0 -112.8	44.2	8/12	66
ABF	Atchafalaya Basin Floodway	0.0 - 13.3	2.0	11/43	25
FPB	Fausse Pointe Basin	0.0 - 86.3	14.1	4/8	50
VB	Verret Basin	0.0 - 6.6	1.7	4/14	27
SMC	South of Morgan City	0.0 - 2.5	0.3	1/9	11

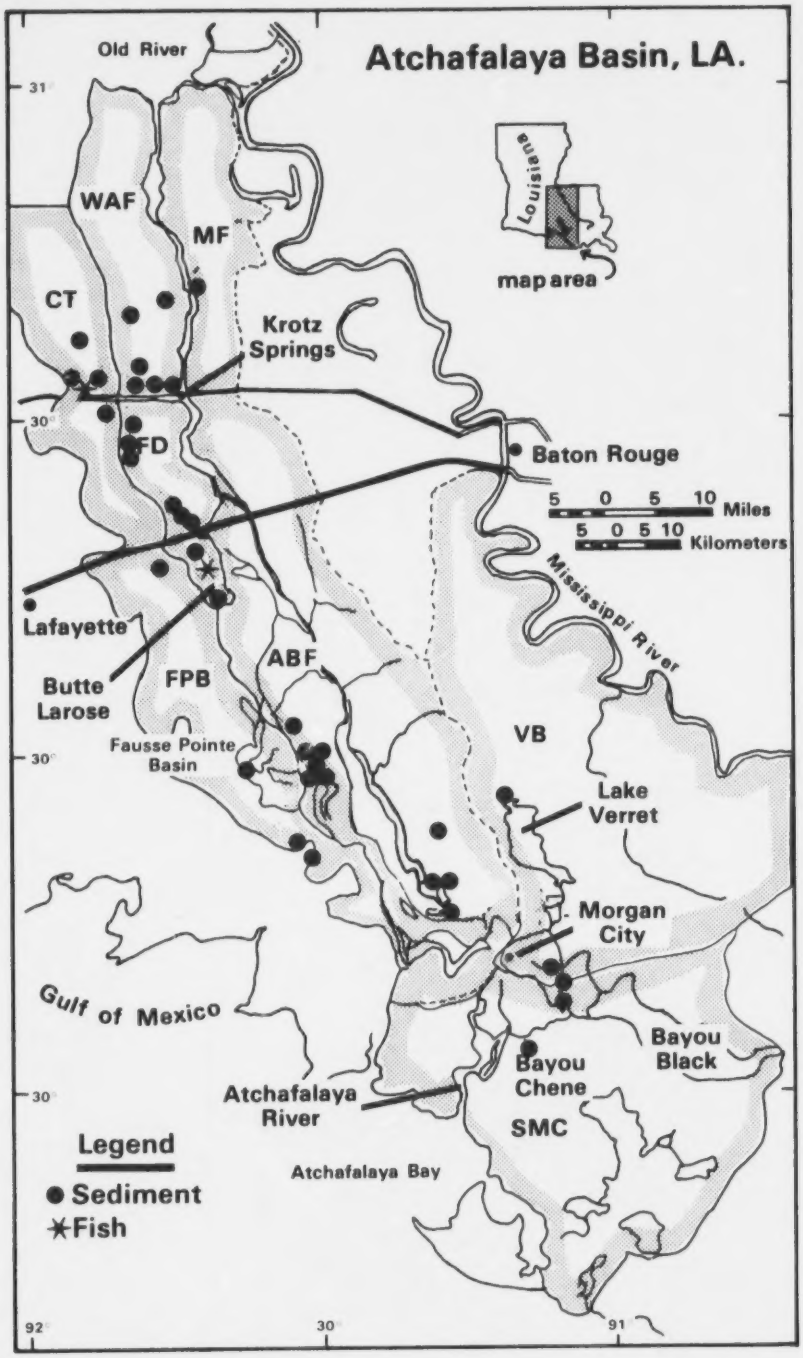

Figure 9. Location of stations where DDT (including DDE, TDE) was detected.

were derived by using station means from the appropriate geographical area. The ratio of the number of sampling stations where DDT was detected to the total number of sampling stations is presented along with the percentage represented by the ratio. Fish specimens were collected from Henderson Lake in the Fordoche area and the Courtableau area. Table 7 lists the DDT (including its metabolites) content in µg/kg of wet weight by species and denotes the area of collection.

The Courtableau area (CT), represented by three sampling stations, had the highest mean DDT bottom sediment concentration (67.7 µg/kg). This area receives water from an extensive agricultural area north of U.S. Highway 190. This area is dewatered by Bayou Courtableau, which drains into the Fordoche area, and also, to a minor extent, by water flowing south into the Fausse Pointe Basin. DDT was detected in all 15 fish specimens collected from the Courtableau area. The mean DDT concentration in the specimens was 367 µg/kg, which is not surprising when one considers the bioconcentration capacities of fish and the relatively high DDT concentrations in the sediments of this area.

The West Atchafalaya Floodway (WAF), represented by seven stations, had the second highest DDT bottom sediment mean of 47.5 µg/kg, and DDT was detected at all sampling stations in the area. The West Atchafalaya Floodway is contained by levees on three sides and by high land on the fourth side. The area receives only local precipitation except during periods of major flooding along the lower Mississippi River. The area supports agricultural activities that are assumed to be the source of the contamination.

The Morganza Floodway (MF) is the eastern counterpart of the West Atchafalaya Floodway. It is also a self-contained area that has agricultural activity and receives only local precipitation. Only one sampling station was located in this area, and bottom sediments from this station had a mean DDT concentration of 150 µg/kg.

Eight sampling stations were located in the Fausse Pointe Basin (FPB), which is west of the Atchafalaya Basin and receives water from the Courtableau area and from local drainage. Agricultural activity is present in this area. The mean DDT concentration in bottom sediments was 14.8 µg/kg with a range of 0.0 to 86.3 µg/kg.

The Verret Basin (VB), represented by 14 stations, is east of the Atchafalaya Basin Floodway. Local precipitation is the only source of water to the area. The Verret Basin has agricultural activity within it, but such activity is much more limited than in the Fausse Point Basin. This is reflected in the lower mean of 1.7 µg/kg DDT in bottom sediments.

Local runoff and the Atchafalaya River water contribute to the annual flooding of the Fordoche area (FD). The flooding of the area is a modified backwater flooding regime. Atchafalaya River water, during high-water months, enters across the southern boundary through the West Atchafalaya Basin protection levee barrow pit after diversion from the river into Bayou Butte La Rose (Bayou La Rose) (Figure 4). The water then flows north through Henderson Lake and northern swamps in accordance with the river stage. In-

TABLE 7. GEOGRAPHICAL AREA WHERE DDT AND ITS METABOLITES (DDE, TDE) WERE DETECTED IN FISH SAMPLES

Geographical Area	Species of Fish	DDT and Its Metabolites (µg/kg wet weight)
Henderson	Bluegill	19
Henderson	Bowfin	3*
Henderson	Largemouth bass	117
Henderson	Largemouth bass	25
Henderson	Redear sunfish	13
Henderson	Spotted gar	83
Henderson	Spotted gar	44
Courtableau	Blue catfish	484
Courtableau	Bluegill	250
Courtableau	Largemouth bass	284
Courtableau	Largemouth bass	210
Courtableau	River carpsucker	128
Courtableau	River carpsucker	289
Courtableau	River carpsucker	331
Courtableau	River carpsucker	1517
Courtableau	River carpsucker	162
Courtableau	Spotted gar	486
Courtableau	Spotted gar	630
Courtableau	White crappie	163
Courtableau	White crappie	222
Courtableau	White crappie	99
Courtableau	White crappie**	250

* Unconfirmed result (below detection limit).

** Homogenous mixture of four white crappie.

troduction of local runoff from outside the Fordoche area occurs across the northern boundary (West Atchafalaya Floodway) and through the Bayou Courtableau structure (Figure 9). The Courtableau area contributes the greatest percentage of water to the area. Dewatering of the Fordoche area occurs by flow through the West Atchafalaya Basin protection levee barrow pit at Butte La Rose and is also dependent on river stages.

Twelve stations were chosen to represent the Fordoche area (FD). The Fordoche area had a mean concentration of 44.2 µg/kg DDT in bottom sediments with a range of 0.0 to 110.6 µg/kg. The influence of water entering the area from the Courtableau area is best represented by sampling station F001 where a mean of 110.5 µg/kg DDT was found in bottom sediments, while water entering from the WAF would be represented best by sampling stations C003 and C007 where mean values of 50 and 20 µg/kg DDT were found in bottom sediments, respectively. Therefore, considering both the relative contribution of water to the Fordoche area and the higher mean concentrations of DDT in bottom sediments from the Courtableau stations, it would appear that the majority of DDT present in the Fordoche area originates from the Courtableau area. DDT was detected in all seven fish specimens collected from Henderson Lake in the Fordoche area. The mean concentration of DDT in these specimens was 43.4 µg/kg.

The Atchafalaya Basin Floodway (ABF) south of U.S. Highway 190 and exclusive of the Fordoche area had a mean concentration of only 2.0 µg/kg DDT in bottom sediment with a range of 0.0 to 13.3 µg/kg. DDT was detected in bottom sediments at only 11 of 43 stations.

Gagliano and van Beek (1975), in August 1973, sampled water and bottom samples from six sampling stations for pesticides in the lower Atchafalaya Basin Floodway. DDT was the only pesticide detected in their investigation. The mean concentration was 30.2 µg/kg DDT in bottom sediment while the mean level in the water was 1.9 µg/liter.

The area south of Morgan City (SMC) had the lowest mean concentration (0.3 µg/kg) of DDT in bottom sediments, with a range of 0.0 to 2.5 µg/kg. DDT was found at only one of nine stations. Water enters this area basically from the Atchafalaya River and, to a limited extent, from Verret Basin.

Table 6 graphically illustrates the distribution and dispersion of DDT in the bottom sediments of the Atchafalaya drainage system. Bottom sediments from the Courtableau area and the West Atchafalaya Floodway had relatively high mean DDT levels of 67.7 and 47.5 µg/kg, respectively. Waters from these two areas drain into the Fordoche area and contribute to the high mean bottom sediment content of 44.2 µg/kg. However, the Atchafalaya Basin Floodway, exclusive of the Fordoche area, which is basically fed by the Mississippi River system, had a low mean bottom sediment content of only 2 µg/kg. The area below Morgan City had the lowest mean concentration (0.3 µg/kg) of DDT in bottom sediments of all the geographical areas sampled.

Three other relatively discrete hydrological systems--the Morganza Floodway, Fausse Pointe Basin, and Verret Basin--were sampled and their mean bottom sediment DDT values of 15.0, 14.1, and 1.7 µg/kg, respectively, appear to reflect the agricultural activity within each system.

POLYCHLORINATED BIPHENYLS

Polychlorinated biphenyls (PCB's) are a class of compounds produced by the chlorination of biphenyls and are registered in the United States under the trade name Aroclor®. Their chemical properties are dependent on their degree of chlorination, which can be determined by their numerical nomenclature, e.g., Aroclor 1242, Aroclor 1254. The first two digits represent the molecular type, while the last two digits represent the average percentage by weight of chlorine. PCB's are relatively nonflammable, have low heat exchange and dielectric properties, and are basically used in capacitors and transformers in industries. The polychlorinated biphenyl water quality criterion is 0.001 µg/liter for the protection and propagation of freshwater and marine aquatic life (EPA, 1976).

The acute effects of PCB's have been determined on a number of aquatic organisms. Studies indicate that freshwater invertebrates are generally more susceptible to acute toxic effects of PCB's than fish (Stalling and Mayer, 1972; Nebeker and Puglisi, 1974). Ninety-six-hour LC_{50} values of 15 µg/liter for Aroclor 1242 and 7.7 µg/liter for Aroclor 1254 were determined for newly hatched fathead minnows, *Pimephales promelas* (Nebeker et al., 1974). In another study 15-day LC_{50} values were determined for the bluegill, *Lepomis macrochirus*, using Aroclor 1242, 1248, and 1254 with the respective results 54, 76, and 204 µg/liter (Stalling and Mayer, 1972). Nebeker and Puglisi (1974) established a 3-week LC_{50} for the invertebrate *Daphnia magna* of 1.3 µg/liter.

In this study, all polychlorinated biphenyls are reported as PCB 1254. PCB 1254 was detected in water or bottom sediment samples at 19 locations (Table 8). Sixteen out of 360 water samples collected at 112 stations and 6 out of 196 bottom sediment samples collected at 96 stations were positive.

Figure 10 shows the location where PCB 1254 was detected in fish, water, and sediment samples (to accurately depict the geographical distribution of PCB 1254, only one symbol per location was used even if multiple occurrences of PCB were detected at that location). The figure also illustrates nine different geographical areas, which are shaded and labeled with letter symbols: West Atchafalaya Floodway north of U.S. Highway 190 (WAF); Morganza Floodway north of U.S. Highway 190 (MF); Courtableau (CT); Fordoche (FD); Atchafalaya Basin Floodway south of U.S. Highway 190 and exclusive of Fordoche (ABF); Fausse Pointe Basin (FPB); Verret Basin (VB); the industrial area south of Morgan City (IA); and south of Morgan City and exclusive of the industrial area (SMC).

Table 9 lists the range and mean concentration of PCB 1254 in bottom sediments and water samples for each geographical area shown in Figure 10. The mean and range calculations were derived by using station means from the appropriate geographical area. The ratio of the number of sampling stations where PCB 1254 was detected to the total number of sampling stations is presented along with the percentage represented by the ratio. Table 10 lists

TABLE 8. STATION, DATE, AND SAMPLE TYPE WHERE PCB 1254 WAS DETECTED IN WATER AND BOTTOM SEDIMENT SAMPLES

Station	Date	Sample Type	
		Water (µg/liter)	Sediment (µg/kg)
C004	9-30-76	0.1	ND
E002	6-11-75	1.3	ND
E004	6-11-75	2.8	ND
E008	4-17-75	0.1	ND
E010	4-17-75	1.2	ND
E013	6-11-75	0.6	ND
E025	6-13-75	0.6	ND
E044	4-18-75	0.1	--
E047	4-16-75	0.1	--
E049	1-20-75	0.1	--
E051	6-14-75	0.7	ND
F004	6-13-75	1.8	ND
F009	6-14-75	5.4	ND
G006	12-11-74	0.7	ND
G008	12-11-74	0.4	30
H003	5-15-75	ND	140
H003	12-11-75	ND	220
H004	12-11-75	ND	41
H005	3-19-75	1.6	--
	6-14-75	ND	68
H006	6-14-75	ND	53

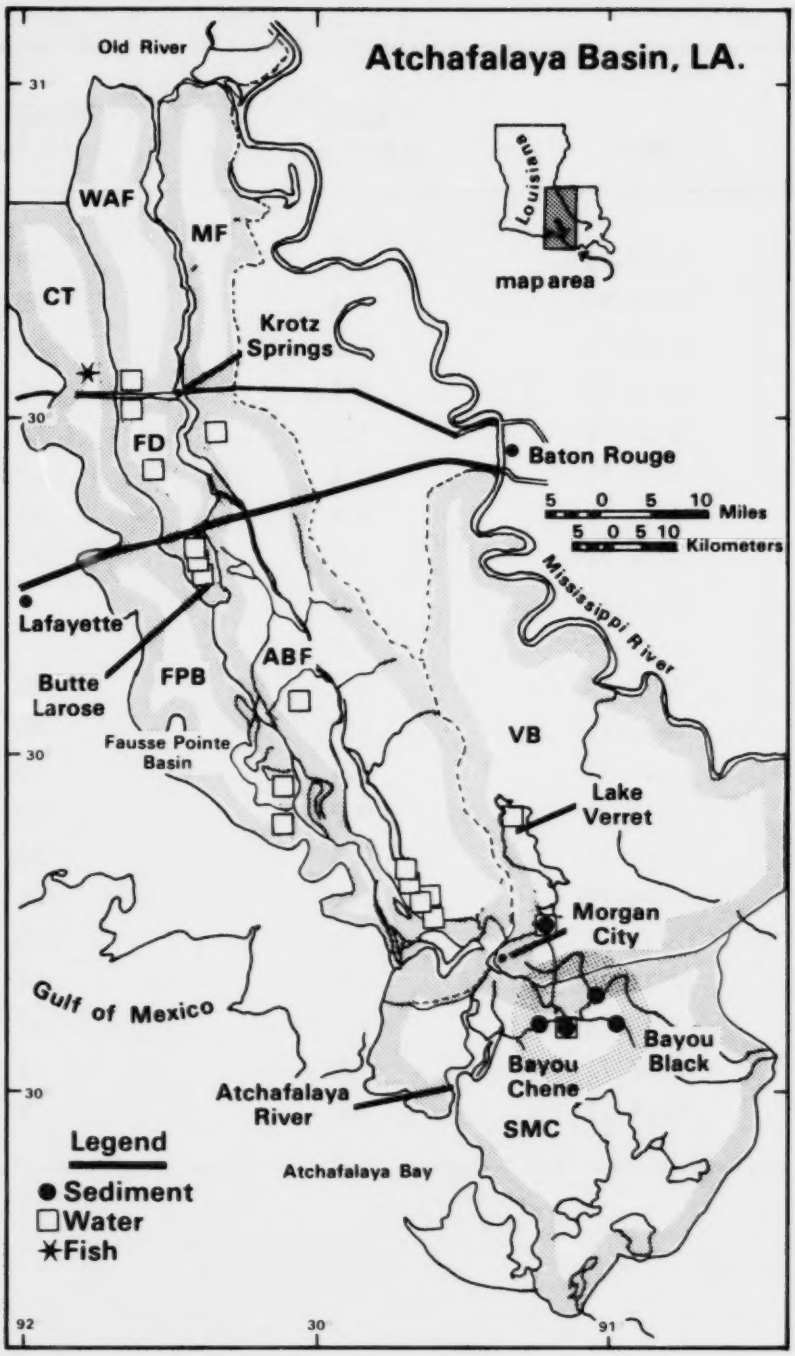

Figure 10. The location of stations where PCB 1254 was detected.

TABLE 9. THE DISTRIBUTION OF PCB 1254 IN WATER AND BOTTOM SEDIMENT SAMPLES BY GEOGRAPHICAL AREA

Area	Water Samples				Sediment Samples			
	Concentration (µg/liter)		Stations That Showed PCB/ Number of Stations	Percent of Stations Showing PCB	Concentration (µg/liter)		Stations That Showed PCB/ Number of Stations	Percent of Stations Showing PCB
	Range	Mean			Range	Mean		
WAF	0.00-0.02	0.002	1/7	14	0.0-0.0	0.0	0/6	0
MF	0.00-0.00	0.000	0/1	0	0.0-0.0	0.0	0/1	0
CT	0.00-0.00	0.000	0/2	0	0.0-0.0	0.0	0/3	0
FD	0.00-0.43	0.120	3/13	23	0.0-0.0	0.0	0/12	0
ABF	0.00-0.14	0.014	6/53	11	0.0-0.0	0.0	0/42	0
VB	0.00-0.18	0.020	2/14	14	0.0-10.0	0.7	1/14	7
FPB	0.00-5.40	0.900	2/8	25	0.0-0.0	0.0	0/8	0
IA	0.00-1.60	0.070	1/4	25	20.5-180.0	62.4	4/1	100
SMC	0.00-0.00	0.000	0/6	0	0.0-0.0	0.0	0/5	0

concentration of PCB 1254 in µg/kg of wet weight by species and indicates the area of collection.

PCB 1254 was not detected in water or sediment samples in the Courtableau area (CT). However, PCB 1254 was detected in one out of seven fish samples from this area (Table 10). PCB 1254 was detected only once in water at seven stations in the West Atchafalaya Floodway and was not detected in bottom sediments. PCB 1254 was not detected in any water or bottom sediment samples from the one sampling station in the Morganza Floodway (MF).

TABLE 10. GEOGRAPHICAL AREA WHERE PCB 1254 WAS DETECTED IN FISH SPECIMENS

Location	Species	Concentration (µg/kg wet weight)
Henderson Lake	Redear sunfish	55
Courtableau	River carpsucker	43
Courtableau	River carpsucker	110
Courtableau	River carpsucker	171
Courtableau	River carpsucker	393

The Fausse Pointe Basin, west of the Atchafalaya Basin, is represented by eight sampling stations. This area receives water from the Courtableau area and from local drainage. PCB 1254 was detected in two of the water samples collected from this area, and the mean concentration was 0.90 µg/liter. It was not detected in any of the bottom sediment samples.

The Verret Basin, east of the Atchafalaya Basin Floodway, is represented by 14 stations. PCB 1254 was found in water at 2 of the 14 stations; however, it was found only once in bottom sediments.

The Fordoche area was represented by 13 water- and 12 sediment-sampling stations. The mean water content was 0.12 µg/liter, but PCB 1254 was not detected in any bottom sediments. The most probable source of this contamination is the Courtableau area. Seven fish specimens were collected in Henderson Lake in the Fordoche area, while 15 were collected in the Courtableau area. The mean PCB 1254 fish content was six times greater in the Courtableau area than the Fordoche area.

The Atchafalaya Basin Floodway (ABF) had a mean PCB 1254 water concentration of 0.01 µg/liter with a mean station range of 0.00 to 0.14 µg/liter. Only 6 of 53 water stations sampled (11 percent) resulted in positive detection of PCB 1254. PCB's were not detected in any bottom sediment samples from the area.

Extensive industrial activities are present in the Bayou Black and Bayou Chenne areas. Four stations (H003, H004, H005, H006) are representative of this industrial area (IA). The highest mean sediment content--62.4 µg/kg--was recorded for this area and is approximately two orders of magnitude greater than the second highest mean bottom sediment concentration for any of the geographical areas. PCB 1254 was detected only once in a water sample from this area. However, the mean concentration for all water samples was 0.07 µg/liter which exceeds the EPA water criterion.

Fifteen water samples, collected from 15 different stations in 5 geographical areas, contained PCB 1254 above the EPA water quality criterion of 0.001 µg/liter. The overall frequency of occurrence was low (4 percent for water samples and 0.5 percent for sediment samples), and the levels detected ranged from 0.1 to 5.4 µg/liter. Station values in excess of the EPA criterion were single occurrences; none of the stations showed detectable PCB levels in prior or subsequent sampling.

The heaviest contamination of PCB's was in the industrial area southwest of Morgan City. In this area, the mean bottom sediment concentration was 62.4 µg/kg, or approximately 100-fold greater than the next highest mean level recorded.

CHLORDANE

Because chlordane is a highly persistent chemical, bioconcentrates in aquatic organisms used for human consumption, and is considered a human carcinogen, chlordane concentrations should be kept as low as feasible. The chlordane water quality criterion is 0.001 ppb for the protection and propagation of fish and other aquatic life (EPA, 1976). EPA (1976) cites several authors in establishing the range for acute toxicity of chlordane in freshwater fish of 5 to 3,000 ppb. EPA (1976) cites Cardwell et al. (1977) to demonstrate that fish can concentrate chlordane directly from the water by a factor of 1,000 to 3,000 times and that invertebrate concentrations may double the fish estimates.

Figure 11 details the locations where chlordane was detected in fish and sediment samples in the Atchafalaya Basin. Chlordane was detected in 7 out of the 360 bottom sediment samples collected in the study. The concentrations ranged from 6 to 30 µg/kg with a mean of 18 µg/kg (Table 11). The sites where chlordane was detected are located in four areas (Courtableau, Fordoche, West Atchafalaya Floodway, and the Buffalo Cove). Two stations were located in both the Courtableau and the Fordoche areas, and one station was located in each of the areas that directly support agriculture or are directly impacted

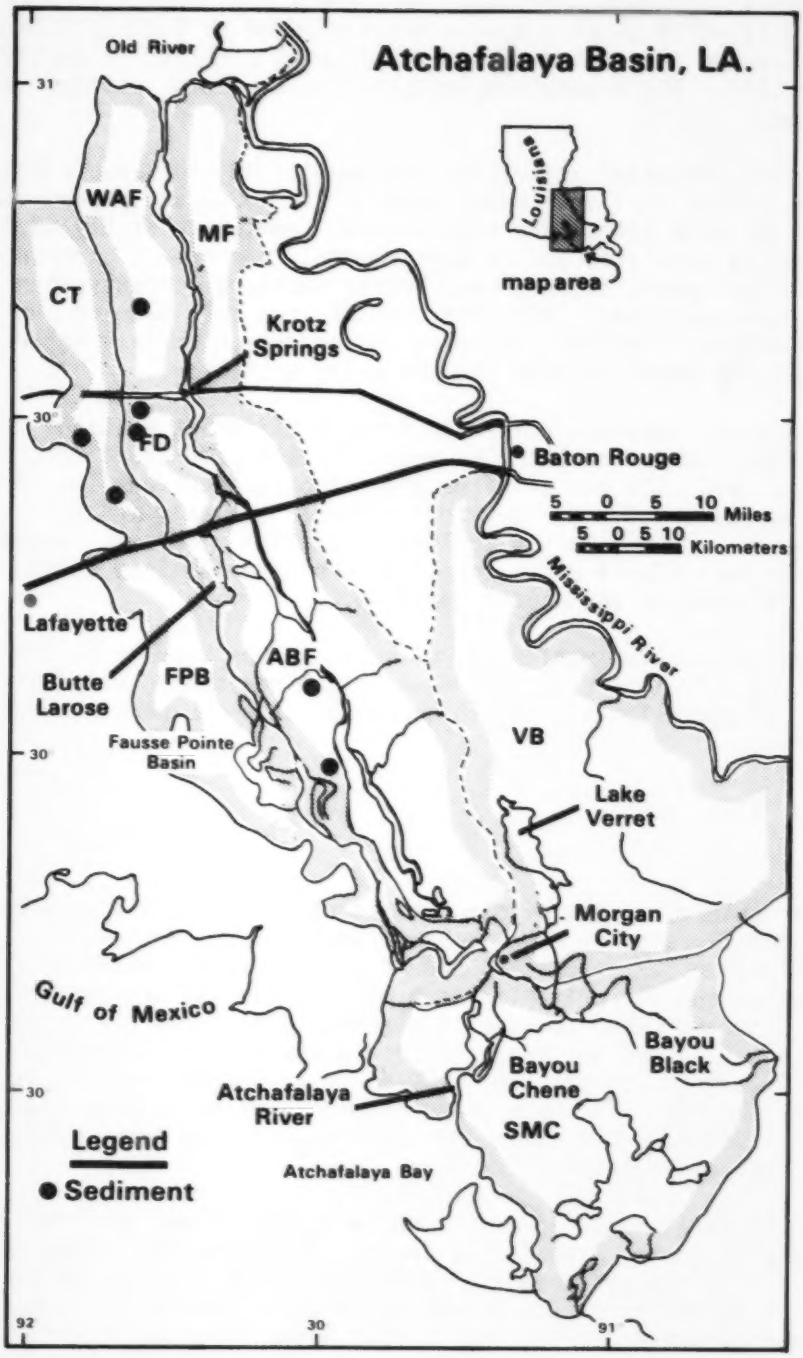

Figure 11. Location of stations where chlordane was detected.

TABLE 11. STATION, DATE, AND SAMPLE TYPE WHERE CHLORDANE WAS DETECTED IN WATER AND BOTTOM SEDIMENT SAMPLES

Station	Date	Sample Type	
		Water (µg/liter)	Sediment (µg/kg)
C002	12-17-75	-	6
E001	12-15-75	-	32
E002	12-15-75	-	19
E022	12-12-75	-	8
E030	6-13-75	ND	9
F001	2-15-75	ND	30
F003	12-12-75	ND	20

ND = Chlordane not detected in sample.

by agricultural drainage. Chlordane was also detected in sediment samples from the Buffalo Cove area. The mean concentration of the positive chlordane samples in the Buffalo Cove area was 8.5 µg/kg; the mean concentration of the positive samples from the areas directly affected by agricultural drainage was 21.5 µg/kg. Since there were no other positive chlordane sediment samples in any other portion of the Atchafalaya system, it would appear likely that the source of chlordane was from the West Atchafalaya Floodway and the Courtableau area.

Chlordane was not detected in any of the water samples. Also, chlordane was not detected in any fish specimens. Chlordane was detected in a spotted gar collected from Henderson Lake but only at an estimated level of 5 µg/kg. Because of the persistence of chlordane in the environment, its large bioconcentration factor, and the low frequency of occurrence, it is concluded that chlordane is not widely distributed in detectable amounts in the water and bottom sediments of the Atchafalaya Basin.

ALDRIN-DIELDRIN

Because dieldrin is a highly persistent chemical, bioconcentrates in aquatic organisms used for human consumption, and is considered a human carcinogen, dieldrin concentrations should be kept as low as feasible. The aldrin-dieldrin water quality criterion is 0.003 ppb for the protection and propagation of fish and other aquatic life (EPA, 1976). Aquatic organisms

metabolically convert aldrin to dieldrin (Gakstatter, 1968). Because dieldrin is as toxic or slightly more toxic than aldrin to aquatic organisms (Jensen and Gaufin, 1966) and because of the metabolic conversion of aldrin to dieldrin, the acceptable water concentration is based on the presence of either aldrin or dieldrin.

Ninety-six-hour LC_{50} values for bluegill (*Lepomis macrochirus*), fathead minnow (*Pimephales promelas*), and green sunfish (*Lepomis cyanellus*) are 7.9, 16.0, and 8.5 ppb, respectively, of dieldrin (Tarzwell and Henderson, 1956). The 20-day LC_{50} for *Acroneuria pacifica* (stonefly naiad) was only 0.2 ppb of dieldrin (Jenson and Gaufin, 1966).

Bioconcentration of aldrin-dieldrin in aquatic organisms (fish, invertebrates, and algae) is well documented under laboratory conditions. In fact, bioconcentrations of aldrin-dieldrin have been recorded up to 260,000 times the initial theoretical water concentration (Kawatski and Schmulbach, 1971).

Figure 12 details the location where aldrin-dieldrin was detected in fish and bottom sediment samples in the Atchafalaya Basin. Dieldrin was not found in water samples and was found in only one bottom sediment sample. The one positive dieldrin bottom sediment sample was collected from the lower Old River and contained 2 µg/kg. Water movement in this area is restricted to times when the navigational locks, which connect lower Old River to the Mississippi River, are open. However, approximately 66 percent of the fish specimens examined contained dieldrin (Table 12). The percentage of positive aldrin-dieldrin fish specimens did not vary greatly as to geographical area. Four of the 7 specimens collected in Henderson Lake were positive, while 10 of the 15 specimens were positive in the Courtableau area. Also, it should be noted that 11 of the 14 positive samples were below detection limits and must be treated as unconfirmed results. Because of the persistence of dieldrin in the environment, the large bioconcentration factors associated with dieldrin, and the low levels at which dieldrin was detected in the fish samples, it is concluded that the fish were exposed to only low levels of aldrin-dieldrin and that dieldrin is not widely distributed in detectable amounts in the water and bottom sediments of the Atchafalaya Basin.

DISTRIBUTION PATTERNS

Two distribution patterns of contaminants in the Atchafalaya Basin are evident. The first is associated with industrial activities, and the second is associated with agricultural activity.

The heaviest contamination of PCB's was in the industrial area southeast of Morgan City. In this area the mean bottom sediment concentration was 62.4 µg/kg or approximately 100-fold greater than the next highest mean bottom sediment level recorded.

Historically, the construction of levees and canals has improved drainage in several areas of the Atchafalaya Basin and allowed for the encroachment and

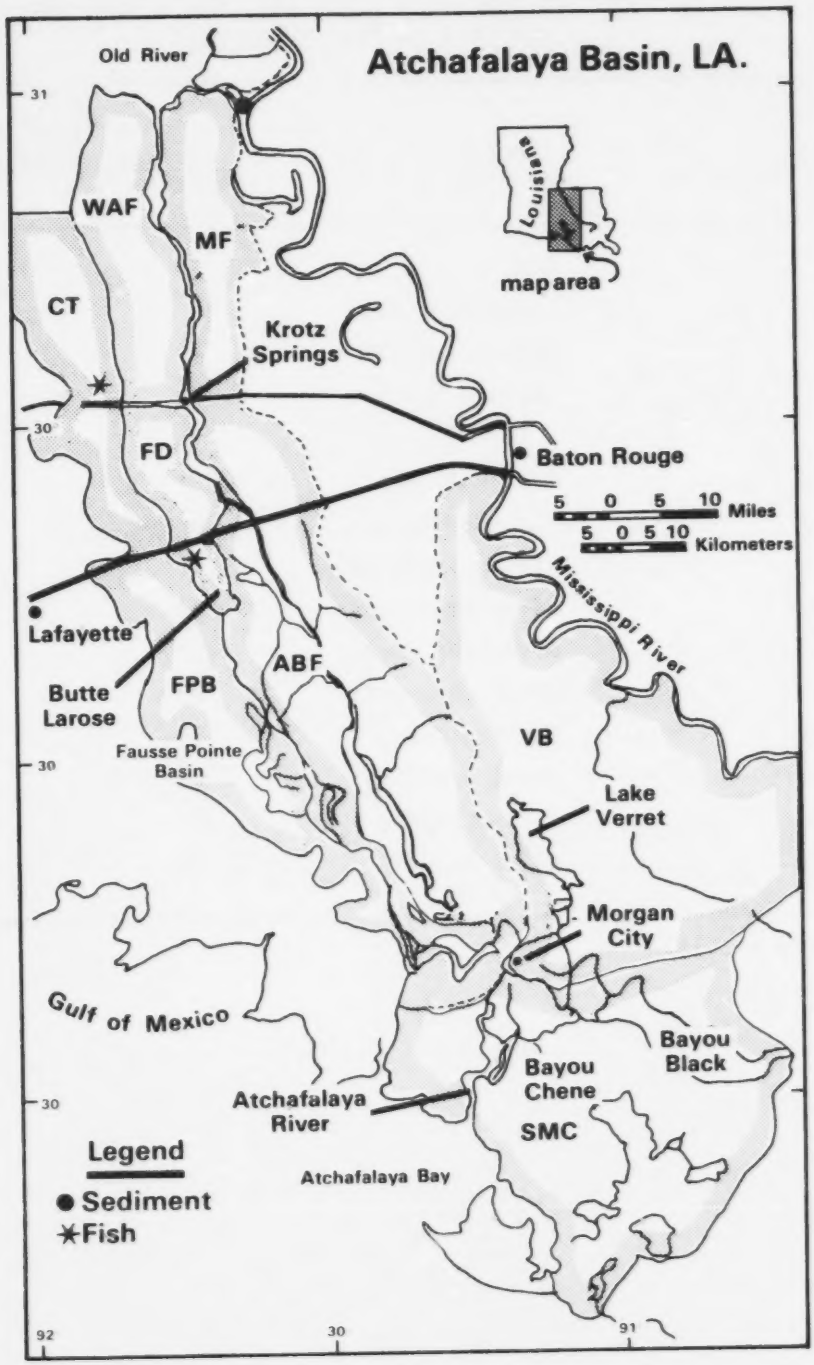

Figure 12. Location of the stations where dieldrin-aldrin was detected.

TABLE 12. GEOGRAPHICAL AREA WHERE DIELDRIN-ALDRIN WAS DETECTED IN FISH SPECIMENS

Geographical Area	Species of Fish	Concentration (µg/kg wet weight) Dieldrin	Aldrin
Fordoche	Bowfin	2*	-
Fordoche	Largemouth bass	11	10
Fordoche	Redear sunfish	2*	-
Fordoche	Spotted gar	4*	-
Courtableau	Blue catfish	8*	-
Courtableau	Largemouth bass	3*	-
Courtableau	River carpsucker	6*	-
Courtableau	River carpsucker	4*	-
Courtableau	River carpsucker	10	-
Courtableau	River carpsucker	8*	-
Courtableau	Spotted gar	8*	-
Courtableau	White crappie	4*	-
Courtableau	White crappie	12	-
Courtableau	White crappie	7*	-

* Unconfirmed result.

expansion of agriculture. These areas--Courtableau, West Atchafalaya Floodway, Fausse Pointe Basin, Morganza Floodway, and the Fordoche area, which is directly impacted by agricultural drainage--contained not only the majority of positive pesticide samples but higher levels of concentration than the other areas studied.

The Atchafalaya Basin (below U.S. Highway 190 and exclusive of the Fordoche area) and the area south of the Basin contained fewer positive pesticide samples, and those were generally at lower levels than in the agriculturally influenced areas.

The pattern of pesticide distribution that emerges in the Atchafalaya system reflects the agricultural activity within or affecting the various hydrological units. Hydrological modifications resulting in lower water levels and favoring the encroachment by or expansion of agricultural activities could be expected to increase pesticide contamination of the Atchafalaya system.

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APPENDIX A

This appendix summarizes the results of all water and bottom sediment samples collected in the Atchafalaya Basin and analyzed for pesticides and PCB's (reported as PCB 1254). It is organized by site-date combinations. When a specific compound was detected, it was listed under the appropriate class of compounds and its concentration recorded. The symbol ND indicates compounds not detected, while an asterisk (*) signifies that the sample was not analyzed for PCB's.

The specific compounds analyzed for their minimum detection levels when treatment method A was employed are listed in Tables 2 and 3 in the text. Treatment method A refers to analysis without initial Florisil cleanup; treatment method B refers to analysis subsequent to Florisil cleanup.

APPENDIX A

Sampling Station	Date	Water Samples			Bottom Sediment Samples		
		Treatment Method	Organo-chlorine Compounds (µg/liter)	Organo-phosphorus Compounds (µg/liter)	Treatment Method	Organo-chlorine Compounds (µg/kg)	Organo-phosphorus Compounds (µg/kg)
A001	11/18/74	A*	ND	ND	-	-	-
A001	12/09/74	A	ND	ND	-	-	-
A001	01/14/75	A	ND	ND	-	-	-
A001	06/10/75	A	ND	ND	-	-	-
A002	11/18/74	A*	ND	ND	-	-	-
A002	12/09/74	A	ND	ND	-	-	-
A002	01/14/75	A	ND	ND	-	-	-
A002	04/17/75	A	ND	ND	-	-	-
A002	06/10/75	A	ND	ND	-	-	-
A003	01/14/75	A	ND	ND	-	-	-
A004	11/18/74	A*	ND	ND	A*	ND	ND
A004	12/09/74	A	ND	ND	A*	ND	ND
A004	01/14/75	A	ND	ND	-	-	-
A004	06/10/75	A	ND	ND	A	ND	ND
A004	12/18/75	-	-	-	B	Dieldrin=2.0 p,p^1-DDE=7.7 p,p^1-TDE=13.4	ND
B001	11/18/74	A*	ND	ND	-	-	-

(Continued)

APPENDIX A (Continued)

Sampling Station	Date	Water Samples			Bottom Sediment Samples		
		Treatment Method	Organo-chlorine Compounds (µg/liter)	Organo-phosphorus Compounds (µg/liter)	Treatment Method	Organo-chlorine Compounds (µg/kg)	Organo-phosphorus Compounds (µg/kg)
B001	12/09/74	A	ND	ND	-	-	-
B001	01/14/75	A	ND	ND	-	-	-
B001	04/17/75	A	ND	ND	-	-	-
C001	11/18/74	A*	ND	ND	A*	p,p^1-DDE=50 p,p^1-TDE=40	ND
C001	12/09/74	A	ND	ND	-	-	-
C001	01/14/75	A	ND	ND	-	-	-
C001	04/14/75	B	ND	ND	A	ND	ND
C001	06/10/75	A	ND	ND	A	p,p^1-DDE=30 p,p^1-TED=20	ND
C001	12/17/75	-	-	-	A	p,p^1-DDE=65 p,p^1-TDE=50	ND
C002	11/18/74	A*	ND	ND	A*	p,p^1-DDE=30 p,p^1-TDE=40	ND
C002	12/09/74	A	ND	ND	-	-	-
C002	01/14/75	A	ND	ND	-	-	-
C002	12/17/75	-	-	-	B	p,p^1-DDE=14.4 p,p^1-TDE=17.5 Tech Chlordane=6.4	ND

(Continued)

APPENDIX A (Continued)

Sampling Station	Date	Water Samples			Bottom Sediment Samples		
		Treatment Method	Organo-chlorine Compounds (µg/liter)	Organo-phosphorus Compounds (µg/liter)	Treatment Method	Organo-chlorine Compounds (µg/kg)	Organo-phosphorus Compounds (µg/kg)
C003	11/18/74	A*	ND	ND	A*	p,p¹-DDE=20 p,p¹-TDE=30	ND
C003	12/09/74	A	ND	ND	-	-	-
C003	01/15/75	A	ND	ND	-	-	-
C004	11/19/74	A*	ND	ND	A*	ND	ND
C004	12/09/74	A	ND	ND	A*	p,p¹-DDE=30 p,p¹-TDE=20	
C004	01/15/75	A	ND	ND	-	-	-
C004	04/17/75	-	-	-	A	p,p¹-DDE=10 p,p¹-TDE=10	ND
C004	04/14/75	A	ND	ND	-	-	-
C004	06/11/75	A	ND	ND	A	p,p¹-DDE=20	ND
C004	09/01/76	A	ND	ND	A	p,p¹-DDE=10	ND
C004	09/30/76	B	PCB 1254=0.1	ND	A	p,p¹-TDE=40 p,p¹-DDE=30	ND
C005	11/19/74	A*	ND	ND	A*	ND	ND
C005	12/09/74	A	ND	ND	A*	ND	ND
C005	01/15/75	A	ND	ND	-	-	-

(Continued)

APPENDIX A (Continued)

Sampling Station	Date	Water Samples			Bottom Sediment Samples		
		Treatment Method	Organo-chlorine Compounds (µg/liter)	Organo-phosphorus Compounds (µg/liter)	Treatment Method	Organo-chlorine Compounds (µg/kg)	Organo-phosphorus Compounds (µg/kg)
C005	04/14/75	A	ND	ND	A	ND	ND
C005	06/11/75	A	ND	ND	A	p,p'-DDE=10	ND
C007	11/29/76	A	ND	ND	A	p,p'-DDE=20	ND
C007	03/08/77	B	ND	ND	-	-	-
C007	04/19/77	B	ND	ND	B	p,p'-DDE=10 p,p'-DTE=10	ND
C007	05/24/77	B	ND	ND	-	-	-
C008	09/01/76	-	-	-	A	p,p'-DDE=30 p,p'-TDE=20	ND
C008	09/30/76	A	ND	ND	A	p,p'-DDT=20 p,p'-DDE=80 p,p'-TDE=50	ND
C008	11/29/76	A	ND	ND	A	p,p'-DDE=90 p,p'-TDE=50	ND
C008	04/19/77	B	ND	ND	B	p,p'-DDE=20 p,p'-TDE=20	ND
C008	05/24/77	B	ND	ND	B	p,p'-DDE=60 p,p'-TDE=40	ND
D001	11/19/74	A*	ND	ND	-	-	-

(Continued)

APPENDIX A (Continued)

Sampling Station	Date	Water Samples			Bottom Sediment Samples		
		Treatment Method	Organo-chlorine Compounds (µg/liter)	Organo-phosphorus Compounds (µg/liter)	Treatment Method	Organo-chlorine Compounds (µg/kg)	Organo-phosphorus Compounds (µg/kg)
D001	12/09/74	A	ND	ND	-	-	-
D001	01/14/75	A	ND	ND	-	-	-
D001	04/14/75	A	ND	ND	A	p,p'-DDE=10 p,p'-DDE=10	ND
D001	06/11/75	-	-	-	A	p,p'-DDE=10	ND
E001	03/19/74	A	ND	ND	-	-	-
E001	05/28/74	A	ND	ND	A	p,p'-DDE=30 p,p'-DDT=40 p,p'-TDE=60	ND
E001	11/15/74	A*	ND	ND	A*	p,p'-DDE=10 p,p'-TDE=10	ND
E001	11/18/74	A	-	-	A*	ND	ND
E001	12/09/74	A	ND	ND	A*	p,p'-DDE=50 p,p'-DDT=70 p,p'-TDE=120	ND
E001	01/15/75	-	ND	ND	-	-	-
E001	04/14/75	A	ND	ND	A	p,p'-DDT=60.0 p,p'-DDE=10.0 p,p'-TDE=30	ND
E001	06/11/75	A	ND	ND	-	-	-

(Continued)

APPENDIX A (Continued)

Sampling Station	Date	Water Samples			Bottom Sediment Samples		
		Treatment Method	Organo-chlorine Compounds (µg/liter)	Organo-phosphorus Compounds (µg/liter)	Treatment Method	Organo-chlorine Compounds (µg/kg)	Organo-phosphorus Compounds (µg/kg)
E001	12/18/75	-	-	-	B	Tech. Chlordane=31.9 p,p'-DDE=48.5 p,p'-DDT=90.0 p,p'-TDE=78.7	-
E002	03/19/74	A	ND	ND	-	-	-
E002	05/28/74	A	ND	ND	A	p,p'-DDE=90 p,p'-TDE=50	ND
E002	11/15/74	A*	ND	ND	A	p,p'-DDE=120 p,p'-TDE=90	ND
E002	12/09/74	A	ND	ND	-	-	-
E002	01/15/75	A	ND	ND	-	-	-
E002	06/11/75	A	PCB 1254=1.3	ND	A	p,p'-DDE=60.0 p,p'-TDE=40.0	ND
E002	12/15/75	-	-	-	B	Tech. Chlordane=19.3 p,p'-DDT=6.0 p,p'-DDE=34.3 p,p'-TDE=27.7	-
E002	03/08/77	-	-	-	B	p,p'-DDE=20 p,p'-TDE=10	
E003	11/14/74	A*	ND	ND	A*	p,p'-DDE=50 p,p'-TDE=50	ND

(Continued)

APPENDIX A (Continued)

Sampling Station	Date	Water Samples			Bottom Sediment Samples		
		Treatment Method	Organo-chlorine Compounds (µg/liter)	Organo-phosphorus Compounds (µg/liter)	Treatment Method	Organo-chlorine Compounds (µg/kg)	Organo-phosphorus Compounds (µg/kg)
E003	12/09/74	A	ND	ND	A*	p,p'-DDE=60 p,p'-TDE=50	ND
E003	01/15/75	A	ND	ND	-	-	-
E003	06/11/75	A	ND	ND	A	p,p'-DDE=30	ND
E003	12/15/75	-	-	-	A	p,p'-DDT=4.9 p,p'-DDE=43.5 p,p'-TDE=5.6	ND
E004	11/19/74	A*	ND	ND	A*	p,p'-DDE=70 p,p'-TDE=70	ND
E004	01/22/75	A	ND	ND	-	-	-
E004	04/17/75	A	ND	ND	A	ND	ND
E004	06/11/75	A	PCB 1254=2.8	ND	A	p,p'-DDE=100.0 p,p'-TDE=40.0	ND
E004	12/15/75	-	-	-	B	p,p'DDE=50.0 p,p'-TDE=28.6	ND
E005	11/19/74	A*	ND	ND	A*	p,p'-DDE=60 p,p'-TDE=60	ND
E005	01/22/75	A	ND	ND	-	-	-
E005	06/12/75	A	ND	ND	A	p,p'-DDE=30	ND

(Continued)

APPENDIX A (Continued)

Sampling Station	Date	Water Samples			Bottom Sediment Samples		
		Treatment Method	Organo-chlorine Compounds (µg/liter)	Organo-phosphorus Compounds (µg/liter)	Treatment Method	Organo-chlorine Compounds (µg/kg)	Organo-phosphorus Compounds (µg/kg)
E006	11/19/74	A*	ND	ND	A*	p,p¹-DDE=30 p,p¹-TDE=40	ND
E006	01/23/75	A	ND	ND	-	-	-
E006	04/17/75	A	ND	ND	-	-	-
E006	06/12/75	A	ND	ND	A	p,p¹-DDE=20	ND
E006	12/15/75	-	-	-	A	ND	ND
E007	01/23/75	A	ND	ND	-	-	-
E007	12/15/75	-	-	-	A	ND	ND
E008	03/19/74	A	ND	ND	-	-	-
E008	05/28/74	A	ND	ND	A	ND	ND
E008	11/15/74	A*	ND	ND	A*	ND	ND
E008	01/23/75	A	ND	ND	-	-	-
E008	04/17/75	B	PCB 1254=0.1	ND	A	ND	ND
E008	06/12/75	A	ND	ND	A	ND	ND
E009	11/19/74	A*	ND	ND	A*	p,p¹-DDE=30 p,p¹-TDE=40	ND
E009	01/23/75	A	ND	ND	-	-	-
E009	06/12/75	A	ND	ND	A	ND	ND

(Continued)

APPENDIX A (Continued)

Sampling Station	Date	Water Samples			Bottom Sediment Samples		
		Treatment Method	Organo-chlorine Compounds (µg/liter)	Organo-phosphorus Compounds (µg/liter)	Treatment Method	Organo-chlorine Compounds (µg/kg)	Organo-phosphorus Compounds (µg/kg)
E009	12/15/75	-	-	-	A	ND	ND
E010	11/19/74	A*	ND	ND	A*	ND	ND
E010	01/23/75	A	ND	ND	-	-	-
E010	04/17/75	B	PCB 1254=1.2	ND	A	ND	ND
E010	12/15/75	-	-	-	A	ND	ND
E011	11/19/74	A*	ND	ND	-	-	-
E011	01/23/75	A	ND	ND	-	-	-
E011	06/12/75	A	ND	ND	B	p,p'-DDE=2.7 p,p'-TDE=3.8	ND
E011	09/01/76	A*	ND	ND	-	-	-
E011	10/26/76	A	ND	ND	A	ND	ND
E011	11/29/76	A	ND	ND	A	ND	ND
E011	03/09/77	B	ND	ND	B	ND	ND
E011	04/20/77	B	ND	ND	B	ND	ND
E012	01/23/76	A	ND	ND	-	-	-
E013	11/19/76	A*	ND	ND	A*	p,p'-DDE=10 p,p'-TDE=30	ND
E013	01/15/75	A	ND	ND	-	-	-

(Continued)

APPENDIX A (Continued)

Sampling Station	Date	Water Samples			Bottom Sediment Samples		
		Treatment Method	Organo-chlorine Compounds (µg/liter)	Organo-phosphorus Compounds (µg/liter)	Treatment Method	Organo-chlorine Compounds (µg/kg)	Organo-phosphorus Compounds (µg/kg)
E013	04/17/75	A	ND	ND	A	ND	ND
E013	06/11/75	A	PCB 1254=0.6	ND	B	ND	ND
E013	12/17/75	-	-	-	A	ND	ND
E014	01/23/75	A	ND	ND	-	-	-
E015	11/19/74	A*	ND	ND	A*	ND	ND
E015	01/23/75	A	ND	ND	-	-	-
E015	06/12/75	A	ND	ND	A	ND	ND
E016	11/20/74	A*	ND	ND	-	-	-
E016	01/23/75	A	ND	ND	-	-	-
E016	06/11/75	A	ND	ND	A	ND	ND
E016	12/10/75	-	-	-	A	ND	ND
E017	11/20/74	A*	ND	ND	-	-	-
E017	01/23/75	A	ND	ND	-	-	-
E017	06/12/75	A	ND	ND	A	ND	ND
E017	12/10/75	-	-	-	A	ND	ND
E018	01/23/75	A	ND	ND	-	-	-
E018	12/10/75	-	-	-	A	ND	ND
E019	03/19/74	A	ND	ND	-	-	-

(Continued)

APPENDIX A (Continued)

Sampling Station	Date	Water Samples			Bottom Sediment Samples		
		Treatment Method	Organo-chlorine Compounds (µg/liter)	Organo-phosphorus Compounds (µg/liter)	Treatment Method	Organo-chlorine Compounds (µg/kg)	Organo-phosphorus Compounds (µg/kg)
E019	05/28/74	A	ND	ND	A	ND	ND
E019	04/17/75	A	ND	ND	A	ND	ND
E019	06/12/75	A	ND	ND	A	ND	ND
E019	12/10/75	-	-	-	A	ND	ND
E020	03/19/74	A	ND	ND	-	-	-
E020	05/28/74	A	ND	ND	A	ND	ND
E020	11/15/74	A	ND	ND	A*	p,p^1-DDE=10 p,p^1-TDE=10	ND
E020	04/16/75	A	ND	ND	-	-	-
E020	06/11/75	A	ND	ND	A	ND	ND
E021	11/20/74	A	ND	ND	A*	ND	ND
E021	01/16/75	A	ND	ND	-	-	-
E021	12/12/75	-	-	-	A	ND	ND
E022	12/12/75	-	-	-	B	p,p^1-DDE=6.7 p,p^1-TDE=9.7 Tech. Chlordane=7.6	ND
E023	11/20/74	A*	ND	ND	A*	ND	ND
E023	01/16/75	A	ND	ND	-	-	-
E024	11/20/74	A	ND	ND	A*	ND	ND

(Continued)

APPENDIX A (Continued)

Sampling Station	Date	Water Samples			Bottom Sediment Samples		
		Treatment Method	Organo-chlorine Compounds (µg/liter)	Organo-phosphorus Compounds (µg/liter)	Treatment Method	Organo-chlorine Compounds (µg/kg)	Organo-phosphorus Compounds (µg/kg)
E024	01/16/75	A	ND	ND	-	-	-
E024	12/12/75	-	-	-	A	ND	ND
E025	11/20/74	A*	ND	ND	A*	p,p'-DDE=20 p,p'-TDE=40	ND
E025	01/16/75	A	ND	ND	-	-	-
E025	06/13/75	A	PCB 1254=0.6	ND	A	ND	ND
E025	12/12/75	-	-	-	A	ND	ND
E026	11/20/74	A*	ND	ND	A*	ND	ND
E026	01/16/75	A	ND	ND	-	ND	ND
E026	12/12/76	-	-	-	A	ND	ND
E027	03/19/74	A	ND	ND	-	-	-
E027	05/28/74	A	ND	ND	A	ND	ND
E027	11/15/74	A*	ND	ND	A*	ND	ND
E027	01/16/75	A	ND	ND	-	-	-
E027	06/13/75	A	ND	ND	A	ND	ND
E027	12/12/75	-	-	-	A	ND	ND
E028	11/20/74	A*	ND	ND	-	-	-
E028	01/16/75	A	ND	ND	-	-	-

(Continued)

APPENDIX A (Continued)

Sampling Station	Date	Water Samples			Bottom Sediment Samples		
		Treatment Method	Organo-chlorine Compounds (µg/liter)	Organo-phosphorus Compounds (µg/liter)	Treatment Method	Organo-chlorine Compounds (µg/kg)	Organo-phosphorus Compounds (µg/kg)
E028	04/16/75	A	ND	ND	-	-	-
E028	06/13/75	A	ND	ND	A	ND	ND
E029	01/16/75	A	ND	ND	-	-	-
E030	01/16/75	A	ND	ND	-	-	-
E030	06/13/75	A	ND	ND	B	Tech. Chlordane=8.8 p,p^1-DDE=3.7 p,p^1-TDE=8.1	ND
E030	12/12/75	-	-	-	A	ND	ND
E031	11/20/74	A*	ND	ND	A*	p,p^1-DDE=20 p,p^1-TDE=20	ND
E031	01/16/75	A	ND	ND	-	-	-
E031	06/13/75	A	ND	ND	A	ND	ND
E031	12/12/75	-	-	-	A	ND	ND
E032	03/19/74	A	ND	ND	-	-	-
E032	05/25/74	A	ND	ND	A	ND	ND
E032	11/15/74	A*	ND	ND	A*	ND	ND
E032	01/20/75	A	ND	ND	-	-	-
E032	04/16/75	A	ND	ND	-	-	-
E032	06/13/75	A	ND	ND	A	ND	ND

(Continued)

APPENDIX A (Continued)

Sampling Station	Date	Water Samples			Bottom Sediment Samples		
		Treatment Method	Organo-chlorine Compounds (µg/liter)	Organo-phosphorus Compounds (µg/liter)	Treatment Method	Organo-chlorine Compounds (µg/kg)	Organo-phosphorus Compounds (µg/kg)
E032	12/12/75	-	-	-	A	ND	ND
E033	01/20/75	A	ND	ND	-	ND	ND
E033	06/13/75	A	ND	ND	A	ND	ND
E033	12/12/75	-	-	-	B	p,p^1-DDE=7.4	ND
E034	11/20/74	A*	ND	ND	-	-	-
E034	12/12/75	-	-	-	A	ND	ND
E034	01/20/75	A	ND	ND	-	-	-
E034	06/13/75	A	ND	ND	A	ND	ND
E034	12/18/75	-	-	-	A	ND	ND
E035	11/20/74	A*	ND	ND	A*	ND	ND
E035	01/20/75	A	ND	ND	-	-	-
E035	04/16/75	A	ND	ND	-	-	-
E035	06/13/75	A	ND	ND	A	ND	ND
E036	11/21/74	A*	ND	ND	A*	ND	ND
E036	01/21/75	A	ND	ND	-	-	-
E036	04/16/75	A	ND	ND	-	-	-
E036	12/17/75	-	-	-	A	ND	ND
E037	01/21/75	A	ND	ND	-	-	-

(Continued)

APPENDIX A (Continued)

Sampling Station	Date	Water Samples			Bottom Sediment Samples		
		Treatment Method	Organo-chlorine Compounds (µg/liter)	Organo-phosphorus Compounds (µg/liter)	Treatment Method	Organo-chlorine Compounds (µg/kg)	Organo-phosphorus Compounds (µg/kg)
E038	01/20/75	A	ND	ND	-	-	-
E038	04/18/75	A	ND	ND	-	-	-
E038	12/17/75	A	ND	-	-	-	-
E039	01/18/75	A	ND	ND	-	-	-
E039	12/16/75	A	ND	ND	-	-	-
E040	03/19/74	A	ND	ND	-	-	-
E040	05/28/74	A	ND	ND	A	ND	ND
E040	04/18/75	A	ND	ND	-	-	-
E041	11/21/74	A	ND	ND	A*	ND	ND
E041	01/21/75	A	ND	ND	-	-	-
E041	04/18/75	A	ND	ND	-	-	-
E041	12/16/75	A	ND	ND	A	ND	ND
E042	03/19/74	A	ND	ND	-	-	-
E042	01/21/75	A	ND	ND	-	-	-
E042	12/16/75	A	ND	ND	A	ND	ND
E043	03/19/74	A	ND	ND	-	-	-
E043	05/28/74	A	ND	ND	A	ND	ND
E043	11/15/74	A*	ND	ND	A*	ND	ND

(Continued)

APPENDIX A (Continued)

Sampling Station	Date	Water Samples			Bottom Sediment Samples		
		Treatment Method	Organo-chlorine Compounds (µg/liter)	Organo-phosphorus Compounds (µg/liter)	Treatment Method	Organo-chlorine Compounds (µg/kg)	Organo-phosphorus Compounds (µg/kg)
E043	01/21/75	A	ND	ND	-	-	-
E043	04/16/75	A	ND	ND	-	-	-
E043	12/16/75	A	ND	ND	A	ND	ND
E044	11/21/74	A*	ND	ND	A*	ND	ND
E044	01/21/75	A	ND	ND	-	-	-
E044	04/18/75	B	PCB 1254=0.10	ND	-	-	-
E044	12/16/75	A	ND	ND	B	p,p^1-DDE=4.2	ND
E045	11/21/74	A*	ND	ND	-	-	-
E045	01/21/75	A	ND	ND	-	-	-
E045	12/16/75	A	ND	ND	A	ND	ND
E046	11/21/74	A	ND	ND	A*	ND	ND
E046	01/21/75	A	ND	ND	-	-	-
E046	12/16/75	A	ND	ND	A	ND	ND
E047	03/19/74	A	ND	ND	-	-	-
E047	05/28/74	A	ND	ND	A	ND	ND
E047	11/14/74	A	ND	ND	A*	ND	ND
E047	01/21/75	A	ND	ND	-	-	-
E047	04/16/75	B	PCB 1254=0.1	ND	-	-	-

(Continued)

APPENDIX A (Continued)

Sampling Station	Date	Water Samples			Bottom Sediment Samples		
		Treatment Method	Organo-chlorine Compounds (µg/liter)	Organo-phosphorus Compounds (µg/liter)	Treatment Method	Organo-chlorine Compounds (µg/kg)	Organo-phosphorus Compounds (µg/kg)
E047	12/16/75	A	ND	ND	-	-	-
E048	03/19/74	A	ND	ND	-	-	-
E048	11/15/74	A*	ND	ND	-	-	-
E048	01/20/75	A	ND	ND	-	-	-
E048	12/15/75	A	ND	ND	-	-	-
E049	01/20/75	B	PCB 1254=0.1	ND	-	-	-
E049	04/18/75	A	ND	ND	A	p,p¹-TDE=10.0	ND
E049	12/15/75	A	ND	ND	A	ND	ND
E050	03/19/74	A	ND	ND	-	-	-
E050	11/14/74	A*	ND	ND	A*	ND	ND
E050	01/20/75	A	ND	ND	-	-	-
E050	04/18/75	A	ND	ND	A	p,p¹-TDE=10.0	ND
E050	12/15/75	A	ND	ND	A	ND	ND
E051	03/19/74	A	ND	ND	-	-	-
E051	05/28/74	A	ND	ND	A	ND	ND
E051	11/14/74	A*	ND	ND	A*	ND	ND
E051	01/18/75	A	ND	ND	-	-	-

(Continued)

APPENDIX A (Continued)

Sampling Station	Date	Water Samples			Bottom Sediment Samples		
		Treatment Method	Organo-chlorine Compounds (µg/liter)	Organo-phosphorus Compounds (µg/liter)	Treatment Method	Organo-chlorine Compounds (µg/kg)	Organo-phosphorus Compounds (µg/kg)
E051	04/15/75	A	ND	ND	A	p,p'-TDE=10.0	ND
E051	06/14/75	A	PCB 1254=0.7	ND	A	ND	ND
E052	11/21/74	A*	ND	ND	-	-	-
E052	01/20/75	A	ND	ND	-	-	-
E052	04/18/75	A	ND	ND	-	-	-
E052	12/15/75	A	ND	ND	A	ND	ND
E053	11/22/74	A*	ND	ND	A*	ND	ND
E053	01/20/75	B	ND	ND	-	-	-
E053	04/18/75	A	ND	ND	-	-	-
E053	12/16/75	A	ND	ND	A	ND	ND
E054	11/22/74	A*	ND	ND	A*	ND	ND
E054	01/20/75	B	ND	ND	-	-	-
E054	04/16/75	A	ND	ND	-	-	-
E054	12/16/75	A	ND	ND	-	-	-
E055	01/21/75	B	ND	ND	-	-	-
E055	12/16/75	A	ND	ND	A	ND	ND
E056	11/22/74	A*	ND	ND	A*	ND	ND

(Continued)

APPENDIX A (Continued)

Sampling Station	Date	Water Samples			Bottom Sediment Samples		
		Treatment Method	Organo-chlorine Compounds (µg/liter)	Organo-phosphorus Compounds (µg/liter)	Treatment Method	Organo-chlorine Compounds (µg/kg)	Organo-phosphorus Compounds (µg/kg)
E056	01/21/75	B	ND	ND	–	–	–
E056	04/18/75	A	ND	ND	–	–	–
E056	12/16/75	A	ND	ND	A	ND	ND
E057	11/22/74	A*	ND	ND	A*	ND	ND
E057	01/20/75	B	ND	ND	–	–	–
E057	04/18/75	A	ND	ND	–	–	–
E057	12/16/75	A	ND	ND	A	ND	ND
E058	11/22/74	A*	ND	ND	A*	ND	ND
E058	01/20/75	B	ND	ND	–	–	–
E058	04/16/75	A	ND	ND	A	ND	ND
E058	12/16/75	A	ND	ND	A	ND	ND
E059	11/22/74	A*	ND	ND	–	–	–
E059	12/11/74	A	ND	ND	–	–	–
E059	01/20/74	A	ND	ND	–	–	–
E059	04/15/75	A	ND	ND	A	ND	ND
E059	06/14/75	A	ND	ND	A	ND	ND
E060	11/21/74	A*	ND	ND	–	–	–

(Continued)

APPENDIX A (Continued)

Sampling Station	Date	Water Samples			Bottom Sediment Samples		
		Treatment Method	Organo-chlorine Compounds (µg/liter)	Organo-phosphorus Compounds (µg/liter)	Treatment Method	Organo-chlorine Compounds (µg/kg)	Organo-phosphorus Compounds (µg/kg)
E061	01/25/75	A	ND	ND	-	-	-
E061	12/15/75	A	ND	ND	-	-	-
E062	01/18/75	A	ND	ND	-	-	-
E062	04/15/75	A	ND	ND	-	-	-
E062	06/14/75	A	ND	ND	-	-	-
E063	12/11/74	A	ND	ND	A*	ND	ND
E063	01/18/75	A	ND	ND	-	-	-
E063	04/18/75	A	ND	ND	-	-	-
E063	12/15/75	A	ND	ND	-	-	-
E063	12/16/75	-	-	-	A	ND	ND
E064	01/18/75	A	ND	ND	-	-	-
E065	01/18/75	A	ND	ND	-	-	-
E065	04/18/75	A	ND	ND	-	-	-
E072	09/01/76	A	ND	ND	A	ND	ND
E072	10/26/76	A	ND	ND	A	ND	ND
E072	11/29/76	-	-	-	A	ND	ND
E072	03/09/77	B	ND	ND	B	ND	ND

(Continued)

APPENDIX A (Continued)

Sampling Station	Date	Water Samples			Bottom Sediment Samples		
		Treatment Method	Organo-chlorine Compounds (µg/liter)	Organo-phosphorus Compounds (µg/liter)	Treatment Method	Organo-chlorine Compounds (µg/kg)	Organo-phosphorus Compounds (µg/kg)
E072	04/20/77	B	ND	ND	B	ND	ND
E072	05/25/77	B	ND	ND	B	ND	ND
F001	11/19/74	A*	ND	ND	A*	p,p'-DDE=0.100 p,p'-TDE=0.80	ND
F001	12/09/74	A	ND	ND	A*	p,p'-DDE=20 p,p'-TDE=10	ND
F001	01/15/75	A	ND	ND	-	-	-
F001	06/11/75	A	ND	ND	A	ND	-
F001	12/15/75	A	ND	ND	B	p,p'-DDE=101.9 p,p'-TDE=58.6 p,p'-DDT=71.3 Tech. Chlordane=29.6	ND
F002	01/23/75	B	ND	ND	-	-	-
F002	12/15/75	A	ND	ND	-	-	-
F002	12/17/75	-	-	-	A	ND	ND
F003	11/19/74	A*	ND	ND	A*	p,p'-DDE=70 p,p'-TDE=10	ND
F003	01/23/75	B	ND	ND	-	-	-
F003	04/12/75	A	ND	ND	-	-	-

(Continued)

APPENDIX A (Continued)

Sampling Station	Date	Water Samples			Bottom Sediment Samples		
		Treatment Method	Organo-chlorine Compounds (µg/liter)	Organo-phosphorus Compounds (µg/liter)	Treatment Method	Organo-chlorine Compounds (µg/kg)	Organo-phosphorus Compounds (µg/kg)
F003	06/12/75	A	ND	ND	A	ND	ND
F003	12/12/75	A	ND	ND	B	p,p¹-DDE=63.9 p,p¹-TDE=75.1 p,p¹-DDT=39.6 Tech. Chlordane=20.03	ND
F004	11/20/74	A*	ND	ND	-	-	-
F004	01/20/75	B	ND	ND	-	-	-
F004	04/16/75	A	ND	ND	-	-	-
F004	06/13/75	A	PCB 1254=1.8	ND	A	ND	ND
F004	06/14/75	A	ND	ND	-	-	-
F005	03/19/74	A	ND	ND	-	-	-
F005	05/28/74	A	ND	ND	A	ND	ND
F005	11/15/74	A*	ND	ND	A*	p,p¹-DDE=20 p,p¹-TDE=20	ND
F005	01/20/75	A	ND	ND	-	-	-
F005	06/13/75	A	ND	ND	A	p,p¹-DDE=10.0 p,p¹-TDE=10.0	-
F005	12/12/75	A	ND	ND	A	p,p¹-DDE=10.0 p,p¹-TDE=10.0	ND

(Continued)

APPENDIX A (Continued)

Sampling Station	Date	Water Samples			Bottom Sediment Samples		
		Treatment Method	Organo-chlorine Compounds (µg/liter)	Organo-phosphorus Compounds (µg/liter)	Treatment Method	Organo-chlorine Compounds (µg/kg)	Organo-phosphorus Compounds (µg/kg)
F006	03/19/74	A	ND	ND	-	-	-
F006	11/15/75	A*	ND	ND	A*	ND	ND
F006	01/20/75	A	ND	ND	-	-	-
F006	04/16/75	A	ND	ND	-	-	-
F006	06/13/75	A	ND	ND	A	ND	ND
F006	12/12/75	A	ND	ND	A	ND	ND
F007	11/21/74	A*	ND	ND	A*	ND	ND
F007	01/20/75	A	ND	ND	-	-	-
F007	12/12/75	A	ND	ND	A	ND	ND
F008	11/21/74	A*	ND	ND	A*	ND	ND
F008	01/20/75	A	ND	ND	-	-	-
F008	06/14/75	A	ND	ND	A	p,p^1-DDE=10.0 p,p^1-TDE=10.0	ND
F008	12/12/75	A	ND	ND	A	ND	ND
F009	11/21/74	A*	ND	ND	A*	ND	ND
F009	04/16/75	A	ND	ND	-	ND	ND
F009	06/14/75	A	PCB 1254=5.40	ND	A	ND	ND

(Continued)

APPENDIX A (Continued)

Sampling Station	Date	Water Samples			Bottom Sediment Samples		
		Treatment Method	Organo-chlorine Compounds (µg/liter)	Organo-phosphorus Compounds (µg/liter)	Treatment Method	Organo-chlorine Compounds (µg/kg)	Organo-phosphorus Compounds (µg/kg)
F009	12/12/75	A	ND	ND	B	p,p¹-DDE=2.9 p,p¹-TDE=3.5	ND
F010	12/17/75	-	-	-	B	p,p¹-DDT=7.1 p,p¹-DDE=57.8 p,p¹-TDE=10.8	
F011	09/01/76	A	ND	ND	A	p,p¹-DDE=30 p,p¹-TDE=20	ND
F011	09/30/76	A	ND	ND	A	p,p¹-DDE=50 p,p¹TDE=40	ND
F011	11/29/76	A	ND	ND	A	p,p¹-DDE=90 p,p¹-TDE=50	ND
F011	03/08/77	B	ND	ND	B	p,p¹-DDE=10 p,p¹-TDE=10	ND
F011	04/19/77	B	ND	ND	B	p,p¹-DDE=20 p,p¹-TDE=20	ND
F011	05/24/77	B	ND	ND	B	p,p¹-DDE=30 p,p¹-TDE=10	ND
G001	03/19/74	A	ND	ND	-	-	-
G001	11/20/74	A*	ND	ND	A*	ND	ND
G001	01/22/75	A	ND	ND	-	-	-

(Continued)

APPENDIX A (Continued)

Sampling Station	Date	Water Samples			Bottom Sediment Samples		
		Treatment Method	Organo-chlorine Compounds (µg/liter)	Organo-phosphorus Compounds (µg/liter)	Treatment Method	Organo-chlorine Compounds (µg/kg)	Organo-phosphorus Compounds (µg/kg)
G001	06/11/75	A	ND	ND	A	ND	ND
G001	12/12/75	A	ND	ND	A	ND	ND
G002	03/19/74	A	ND	ND	-	-	-
G002	11/15/74	A*	ND	ND	A*	ND	ND
G002	01/21/75	A	ND	ND	-	-	-
G002	06/11/74	A	ND	ND	A	ND	ND
G002	12/12/75	A	ND	ND	A	ND	ND
G003	03/19/74	A	ND	ND	-	-	-
G003	05/23/74	A	ND	ND	A	ND	ND
G003	11/15/74	A*	ND	ND	A*	ND	ND
G003	01/21/75	A	ND	ND	-	-	-
G003	04/15/75	A	ND	ND	A	ND	ND
G003	12/12/75	A	ND	ND	A	ND	ND
G004	11/20/74	A*	ND	ND	A*	ND	ND
G004	01/21/74	A	ND	ND	-	-	-
G004	12/11/75	A	ND	ND	A	ND	ND
G005	05/28/74	A	ND	ND	A	ND	ND

(Continued)

APPENDIX A (Continued)

Sampling Station	Date	Water Samples			Bottom Sediment Samples		
		Treatment Method	Organo-chlorine Compounds (µg/liter)	Organo-phosphorus Compounds (µg/liter)	Treatment Method	Organo-chlorine Compounds (µg/kg)	Organo-phosphorus Compounds (µg/kg)
G005	12/11/74	A	ND	ND	A*	ND	ND
G005	01/17/75	A	ND	ND	-	-	-
G005	04/18/75	A	ND	ND	-	-	-
G005	06/14/75	A	ND	ND	A	p,p^1-DDE=20	ND
G006	05/28/74	A	ND	ND	A	ND	ND
G006	12/11/74	B	PCB 1254=0.7	ND	A*	ND	ND
G006	01/18/75	A	ND	ND	-	-	-
G006	04/15/75	A	ND	ND	A	ND	ND
G006	06/14/75	A	ND	ND	A	ND	ND
G007	05/28/74	A	ND	ND	A	ND	ND
G007	12/11/74	A	ND	ND	A*	ND	ND
G007	01/18/75	A	ND	ND	-	-	-
G007	12/11/75	A	ND	ND	A	ND	ND
G008	03/19/74	A	ND	ND	-	-	-
G008	11/14/74	A*	ND	ND	A*	ND	ND
G008	12/11/74	B	PCB 1254=0.4	ND	B	PCB 1254=30.2	ND
G008	01/18/75	A	ND	ND	-	-	-

(Continued)

APPENDIX A (Continued)

Sampling Station	Date	Water Samples			Bottom Sediment Samples		
		Treatment Method	Organo-chlorine Compounds (µg/liter)	Organo-phosphorus Compounds (µg/liter)	Treatment Method	Organo-chlorine Compounds (µg/kg)	Organo-phosphorus Compounds (µg/kg)
G008	06/14/75	A	ND	ND	A	ND	ND
G008	12/11/75	A	ND	ND	A	ND	ND
G009	03/19/74	A	ND	ND	-	-	-
G009	05/28/74	A	ND	ND	A	ND	ND
G009	11/14/74	A*	ND	ND	-	-	-
G009	01/18/75	A	ND	ND	-	-	-
G009	04/15/75	A	ND	ND	A	ND	ND
G009	12/11/75	A	ND	ND	A	ND	ND
G009	12/11/75	A	ND	ND	A	ND	ND
G010	01/18/75	A	ND	ND	-	-	-
G010	06/14/75	A	ND	ND	A	ND	ND
G010	12/11/75	A	ND	ND	A	ND	ND
G011	01/17/75	A	ND	ND	-	-	-
G011	04/18/75	A	ND	ND	A	p,p^1-DDE=10.0	ND
G011	06/14/75	A	ND	ND	A	ND	ND
G012	11/23/74	A*	ND	ND	-	-	-
G012	12/10/74	A	ND	ND	-	-	-

(Continued)

APPENDIX A (Continued)

Sampling Station	Date	Water Samples			Bottom Sediment Samples		
		Treatment Method	Organo-chlorine Compounds (µg/liter)	Organo-phosphorus Compounds (µg/liter)	Treatment Method	Organo-chlorine Compounds (µg/kg)	Organo-phosphorus Compounds (µg/kg)
G012	12/11/74	-	-	-	A*	ND	ND
G012	01/17/75	A	ND	ND	-	-	-
G012	06/14/75	A	ND	ND	B	ND	ND
G013	01/17/75	A	ND	ND	-	-	-
G013	04/18/75	A	ND	ND	A	p,p'-DDE=10.0	ND
G014	11/23/74	A*	ND	ND	-	-	-
G014	12/10/74	A	ND	ND	A*	ND	ND
G014	01/17/75	A	ND	ND	-	-	-
G014	04/18/75	A	ND	ND	A	p,p'-DDE=10.0	ND
G014	06/14/75	A	ND	ND	A	ND	ND
G014	12/17/75	A	ND	ND	A	ND	ND
H001	01/18/75	A	ND	ND	-	-	-
H001	12/11/75	A	ND	ND	-	-	-
H002	01/17/75	B	ND	ND	-	-	-
H002	12/11/75	A	ND	ND	A	ND	ND
H003	11/23/74	A*	ND	ND	-	-	-
H003	12/10/74	A	ND	ND	A*	ND	ND
H003	01/17/75	A	ND	ND	-	-	-

(Continued)

APPENDIX A (Continued)

Sampling Station	Date	Water Samples			Bottom Sediment Samples		
		Treatment Method	Organo-chlorine Compounds (µg/liter)	Organo-phosphorus Compounds (µg/liter)	Treatment Method	Organo-chlorine Compounds (µg/kg)	Organo-phosphorus Compounds (µg/kg)
H003	04/15/75	A	ND	ND	A	PCB 1254=140.0	ND
H003	06/14/75	A	ND	ND	-	-	-
H003	12/11/75	A	ND	ND	A	PCB 1254=220.0	ND
H004	11/23/74	A*	ND	ND	-	-	-
H004	12/10/74	A	ND	ND	A*	ND	ND
H004	01/17/75	A	ND	ND	-	-	-
H004	06/14/75	A	ND	ND	A	ND	ND
H004	12/11/75	A	ND	ND	B	PCB 1254=41.4	-
H005	03/19/74	A	PCB 1254=1.6	ND	-	-	-
H005	05/28/74	A	ND	ND	A	ND	ND
H005	11/14/74	A*	ND	ND	-	-	-
H005	12/10/74	A	ND	ND	A*	ND	ND
H005	01/17/75	A	ND	ND	-	-	-
H005	04/15/75	A	ND	ND	A	ND	ND
H005	06/14/75	A	ND	ND	B	PCB 1254=68.1	ND
H006	03/19/74	A	ND	ND	-	-	-
H006	11/14/74	A*	ND	ND	A*	ND	ND

(Continued)

APPENDIX A (Continued)

Sampling Station	Date	Water Samples			Bottom Sediment Samples		
		Treatment Method	Organo-chlorine Compounds (µg/liter)	Organo-phosphorus Compounds (µg/liter)	Treatment Method	Organo-chlorine Compounds (µg/kg)	Organo-phosphorus Compounds (µg/kg)
H006	12/10/74	A	ND	ND	A*	ND	ND
H006	01/17/75	A	ND	ND	-	-	-
H006	06/14/75	A	ND	ND	B	PCB 1254=52.6	ND
H006	12/11/75	A	ND	ND	-	-	-
H006	12/11/76	-	-	-	A	ND	ND
H007	11/23/74	A*	ND	ND	-	-	-
H007	12/10/74	A	ND	ND	A*	ND	ND
H007	01/17/75	A	ND	ND	-	-	-
H007	04/15/75	A	ND	ND	A	p,p^1-TDE=10.0	ND
H007	06/14/75	A	ND	ND	A	ND	ND
H007	12/11/75	A	ND	ND	A	ND	ND
H008	11/22/74	A*	ND	ND	-	-	-
H008	12/10/74	A	ND	ND	-	-	-
H008	01/17/75	A	ND	ND	-	-	-
H008	12/11/75	A	ND	ND	A	ND	ND
H009	11/22/74	A*	ND	ND	-	-	-
H009	12/10/74	A	ND	ND	A*	ND	ND

(Continued)

APPENDIX A (Continued)

Sampling Station	Date	Water Samples			Bottom Sediment Samples		
		Treatment Method	Organo-chlorine Compounds (µg/liter)	Organo-phosphorus Compounds (µg/liter)	Treatment Method	Organo-chlorine Compounds (µg/kg)	Organo-phosphorus Compounds (µg/kg)
H009	01/17/75	A	ND	ND	-	-	-
H009	04/15/75	A	ND	ND	A	ND	ND
H009	12/11/75	A	ND	ND	A	ND	ND
H010	12/10/74	A	ND	ND	A*	ND	ND
H010	01/17/75	A	ND	ND	-	-	-
H010	12/11/75	A	ND	ND	A	ND	ND
H011	11/22/74	A*	ND	ND	-	-	-
H011	12/10/74	A	ND	ND	A*	ND	ND
H011	01/17/75	A	ND	ND	-	-	-
H011	12/11/75	A	ND	ND	A	ND	ND
H012	11/22/74	A	ND	ND	-	-	-
H012	12/10/74	A	ND	ND	A*	ND	ND
H012	01/17/75	A	ND	ND	-	-	-
H012	04/15/75	A	ND	ND	A	ND	ND
H013	11/22/75	A*	ND	ND	A*	ND	ND
H013	12/10/74	A	ND	ND	-	-	-
H013	01/17/75	A	ND	ND	-	-	-
H013	12/11/75	A	ND	ND	A	ND	ND

(Continued)

APPENDIX A (Continued)

Sampling Station	Date	Water Samples			Bottom Sediment Samples		
		Treatment Method	Organo-chlorine Compounds (µg/liter)	Organo-phosphorus Compounds (µg/liter)	Treatment Method	Organo-chlorine Compounds (µg/kg)	Organo-phosphorus Compounds (µg/kg)
H014	12/11/75	A	ND	ND	-	-	-